Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Issued November 24, 1916.

ALASKA AGRICULTURAL EXPERIMENT STATIONS.

C. C. GEORGESON, Agronomist in Charge.

REPORT OF

THE ALASKA AGRICULTURAL EXPERIMENT STATIONS.

1915.

UNDER THE SUPERVISION OF

STATES RELATIONS SERVICE,
Office of Experiment Stations,
U. S. DEPARTMENT OF AGRICULTURE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1916.

ALASKA AGRICULTURAL EXPERIMENT STATIONS, SITKA, KODIAK, RAMPART, AND FAIRBANKS.

[Under the supervision of A. C. TRUE, Director of the States Relations Service, United States Department of Agriculture.]

E. W. ALLEN, *Chief of Office of Experiment Stations.*

WALTER H. EVANS, *Chief of Division of Insular Stations, Office of Experiment Stations.*

STATION STAFF.

C. C. GEORGESON, *Agronomist in Charge, Sitka.*
J. W. NEAL, *Assistant in Charge, Fairbanks.*
M. D. SNODGRASS, *Assistant in Charge, Kodiak.*
G. W. GASSER, *Assistant in Charge, Rampart.*
J. P. ANDERSON, *Horticulturist, Sitka.*
T. D. CRIPPEN, *Assistant, Rampart.*
H. E. PRATT, *Animal Husbandman, Kodiak.*
J. CARL LANEY, *Assistant Dairyman, Kodiak.*

LETTER OF TRANSMITTAL.

ALASKA AGRICULTURAL EXPERIMENT STATIONS,
Sitka, Alaska, March 6, 1916.

SIR: I have the honor to submit herewith a report of the work of the Alaska Agricultural Experiment Stations, 1915.

Very respectfully,

C. C. GEORGESON,
Agronomist in Charge.

Dr. A. C. TRUE,
Director States Relations Service,
U. S. Department of Agriculture, Washington, D. C.

Publication recommended.
A. C. TRUE, *Director.*

Publication authorized.
D. F. HOUSTON, *Secretary of Agriculture.*

CONTENTS.

	Page.
Summary of work at the stations	7
General considerations	7
Sitka Station	8
Plant breeding	8
Strawberries	8
Raspberry-salmonberry	9
Raspberry-thimbleberry	9
Seedling gooseberries	10
Cranberries	10
Blueberries and huckleberries	10
Apple seedlings	10
Fruit tests	11
Apples	11
Cherries	11
Bush fruits	12
Distribution of nursery stock	12
The root-maggot pest	13
Fairbanks Station	13
Grain crops	13
Alfalfa	15
The fair	15
Potatoes	16
Turnip seed	16
Hogs	16
Improvements	17
Distribution of seed grain	17
Hardy cattle for the interior	17
Rampart Station	17
Alfalfa	18
Vetches	19
Work with grain	19
Barley	20
Oats	20
Wheat	20
Rye	21
Buckwheat	21
Miscellaneous work	21
Kodiak Station	22
The herd	22
Dairy work	22
The sheep	23
Restoring pastures	24
Chemical analysis of ash	25
Improvements	25
Changes in personnel	26
Breeding of horses	26
An agricultural reconnoissance of Matanuska Valley	26
Needs of the stations	28

Page
Garden notes at Sitka Station 29
Apples 29
Nursery stock 29
Strawberries 29
Currants 30
Gooseberries 30
Raspberries 30
Blueberries 31
Cranberries 31
Cherries 31
Plums and other fruits 31
Vegetables 32
Potatoes 32
Cabbage 33
Cauliflower and broccoli 33
Brussels sprouts 34
Kale 34
Kohl-rabi 34
Turnips 34
Rutabagas 34
Radishes 35
Peas 35
Beans 35
Beets 35
Carrots 35
Parsnips 36
Onions 36
Asparagus 36
Rhubarb 36
Lettuce 36
Celery 36
Parsley 36
Spinach 36
Corn salad 36
Cucumbers and tomatoes 37
Herbs 37
Ornamentals 37
Trees 37
Shrubs 37
Roses 37
Perennials 37
Annuals 38
Greenhouse 38
Plant diseases 39
Club root 39
Black rot 39
Botrytis 39
Potato diseases 40
Apple scab 40
Mildews 40
Rusts 40
Witches' brooms 41
Pea and bean diseases 41
Leaf spots 41
Insect pests 41

Page.
Report of work at Fairbanks Station 42
Climatic conditions 43
Grain crops 44
Winter grains 48
Alfalfa 49
Clover 50
The garden 50
Flowers 51
The turnip crop 52
The potato crop 52
Live stock 54
Report of work at Rampart Station 54
Climatic and general crop conditions 54
General work 57
Legumes 58
Hybridization 60
Grain selection 61
Spring wheat 62
Winter wheat 63
Spring rye 63
Winter rye 63
Oats 64
Barley 65
Buckwheat 66
Hemp 66
Flax 66
Broad beans 67
Strawberries 67
The garden 67
Potatoes 68
Report of work at Kodiak Live Stock and Breeding Station 69
Climatic conditions 71
Crop work 72
Potatoes 75
Vegetables 76
Hay making and silage 76
Restoration of vegetation on volcanic ash covered lands 78
Galloway cattle 79
Dairy work with Galloways 80
The sheep 80
Suggestions for future work 81
New settlers on Kodiak Island 81
Reports from seed and plant distribution 82
Condensed meteorological reports 93

ILLUSTRATIONS.

Page.

PLATE I. Fig. 1.—Whitney crab apple, Sitka Station. Fig. 2.—Livland Raspberry apple, Sitka Station 32

II. Fig. 1.—Spaulding No. 4 potatoes from two hills, Sitka Station. Fig. 2.—Celery grown at Sitka Station 32

III. Fig. 1.—Russian spring wheat H. G., Fairbanks Station. Fig. 2.—Romanov spring wheat, Fairbanks Station 44

IV. Fig. 1.—Oat and barley fields, Fairbanks Station. Fig. 2.—Sixty Day oats, Fairbanks Station 44

V. Fig. 1.—Finnish Black oats, Fairbanks Station. Fig. 2.—Clover, pansies, and sweet peas, Fairbanks Station 48

VI. Fig. 1.—Tomatoes grown out of doors, Fairbanks Station. Fig. 2.—Potato field, Fairbanks Station 48

VII. Fig. 1.—Cutting oats for hay, Rampart Station. Fig. 2.—Storing hay, Rampart Station 56

VIII. Fig. 1.—Plant of Grimm alfalfa, Rampart Station. Fig. 2.—Variation in pods of Grimm alfalfa as grown at Rampart Station 56

IX. Fig. 1.—Omsk alfalfa, *Medicago falcata*, grown at Rampart Station, three-year-old plant. Fig. 2.—Variation in pods of *Medicago falcata* grown at Rampart Station 60

X. Fig. 1.—Alfalfa grown in rows for variation studies, Rampart Station. Fig. 2.—Vetch, *Vicia cracca*, at Rampart Station 60

XI. Fig. 1.—Spring wheats grown at Rampart Station. Fig. 2.—Sports of winter rye (No. 281), Rampart Station 64

XII. Fig. 1.—Hybrid barleys, Rampart Station. Fig. 2.—Strawberries grown at Rampart Station 64

XIII. Fig. 1.—Oat field, Kodiak Station. Fig. 2.—Cow kale, Kodiak Station 72

XIV. Fig. 1.—Cutting oats for hay, Kodiak Station. Fig. 2.—Loading hay, Kodiak Station 72

XV. Fig. 1.—Telephone peas, 8 feet tall, John E. Barrett's homestead, McCarthy, Alaska. Fig. 2.—Potatoes grown by John E. Barrett, McCarthy, Alaska 88

XVI. Fig. 1.—School garden, Shungnak. Fig. 2.—Native garden, Shungnak 88

XVII. Fig. 1.—Turnips grown at Shungnak. Fig. 2.—Kohl-rabi grown at Shungnak 92

XVIII. Fig. 1.—Native garden, Shungnak. Fig. 2.—Wilcox's potato patch, Shungnak 92

XIX. Map showing agricultural regions in Alaska 92

REPORT OF THE ALASKA AGRICULTURAL EXPERIMENT STATIONS, 1915.

By C. C. Georgeson, *Agronomist in Charge.*

SUMMARY OF WORK AT THE STATIONS.

GENERAL CONSIDERATIONS.

The season of 1915 was favorable to farming throughout the entire Territory. In consequence crops of all kinds, both grains and vegetables, were better than those raised in any previous year. At and Fairbanks and Rampart stations the early spring induced early seeding, but after the grain crops were well started they became somewhat stunted for lack of rain. There was practically no precipitation in the interior during the month of June, and not until the beginning of July did adequate rains fall, but by that time the grain had made its growth. The result was that the straw was short, but the heads were well filled, and all the varieties of grain not only ripened but matured unusually early.

In the coast region the rainfall was also less than usual during the first half of the summer. This was favorable to all kinds of fruits and vegetables. At the Sitka Station the strawberries began to mature by the middle of June, the earliest date on record. The Kodiak Station was affected unfavorably by this weather. The grass did not grow with its normal vigor, and grain crops seeded for hay were stunted for lack of rain. Nevertheless, there was sufficient pasture to keep the cattle in fine condition. When it did begin to rain it rained so continuously that it interfered seriously with hay making, and barely enough hay and silage was saved to carry the herd through the winter.

The farmers and gardeners throughout the whole Territory report a favorable season. Vegetables and berries were never better or produced in greater abundance.

To point out the striking difference between the seasons of 1914 and 1915, there is given below a condensed temperature record taken from 18 stations, which represent the whole Territory.

Average daily mean temperature for the months of May, June, July, and August, 1914 and 1915.

Station.	1914	1915	Station.	1914	1915
	°F.	°F.		°F.	°F.
Allakaket	51.2	54.4	Ketchikan	52.7	57.3
Calder	48.8	53.9	Klukwan	53.7	57.6
Candle [1]	54.2	52.9	Kodiak [2]	50.9	53.8
Eagle	52.0	53.9	Nome	46.7	45.1
Fairbanks Experiment Station	54.6	58.8	Rampart	56.2	56.9
Fort Liscum	51.6	53.9	Seward	52.1	56.2
Fortmann Salmon Hatchery	54.3	58.9	Sitka	52.1	55.9
Haines [1]	57.2	60.1	Tanana [3]	52.2	54.4
Juneau	52.8	55.9	Valdez	49.3	52.7

[1] June, July, and August. [2] May, July, and August. [3] May, June, and August.

SITKA STATION.

The Sitka Station is devoted entirely to fruit and vegetable growing and plant breeding. It is designed to be representative of the coast region. It was demonstrated early in this work that the coast region is not adapted to grains. Grains will mature, but the heavy rainfall in the latter part of the summer, peculiar to this region, makes it almost impossible to save the crop. The region is admirably adapted to the growing of berries and of vegetables, and the results with tree fruits during the last few years inspire the hope that apples and cherries may also be grown here if early maturing varieties are selected.

PLANT BREEDING.

Plant breeding is a leading feature of the work. An effort is made to develop new varieties, particularly of berries and fruits, which shall be better adapted to the region than those which have originated in more southerly latitudes.

Strawberries.—The efforts in the production of new varieties of strawberries have been referred to in several of the more recent reports, and it is therefore not necessary to go into details here, except to say that the hybrids originated have resulted from crosses between the wild species of strawberries in Alaska and cultivated varieties. There are two indigenous species, which differ widely from each other. The coast species is never found far from the salt-water beaches. It is abundant along the beach from Icy Strait, west to Prince William Sound. It produces berries of delicious flavor and aroma. The interior species is not found at all in the coast region, but is scattered over the interior valleys, though it is nowhere abundant. It is hardier than the coast species, and this is its chief value in breeding work, for its fruit is very small and of no particular merit. It does not grow well in the wet climate of

the coast, and it is maintained at the Sitka Station with difficulty. Both of the native species have been used as the male parent in making the crosses. The work has succeeded beyond expectation. About 10 per cent of the hybrid plants produced have had sufficient merit to be retained for tests and further experiment. The coast species has given the best results in number of valuable hybrids produced. The hybrids which have the interior species for one of their parents all show improvement over the wild species. Each year yields a few plants of greater promise than any that have preceded them, and the work will therefore be continued and extended, with the almost certain assurance that still better varieties will in time be forthcoming. Nearly all the hybrids have the fault of being vegetatively too vigorous. The leaves are too large and too abundant. They shade the fruit so that in many varieties it does not color well, and the heavy growth of leaves also keeps the fruit wet all the time in rainy weather and induces early decay. The berries are also in most cases too soft to ship well, which is a serious fault when berries are grown for market. On the other hand, scores of the best hybrid plants produce very large and delicious fruit, and some of them grow berries which retain the pleasant aroma peculiar to the wild species.

The station has not disseminated these hybrids because of the belief that something still better will be produced in the near future. It is of much interest to note that hybrids with the coast species as one of the parents have been found to be hardy at both Rampart and Fairbanks stations. At Rampart some of them fruited for the first time in 1915. (See Pl. XII, fig. 2.) However, the plants are not so vigorous or the fruit so large as when grown in the coast region. Some of the hybrids that have the interior species for one of their parents are expected to be better adapted to that region than are those now under test.

Raspberry-salmonberry.—Reference has been made to these crosses in several former reports, and this subject will be dismissed with this final note. They are not a success. Most of the flowers are sterile, and the seeds that have been collected from occasional berries have not sufficient vitality to grow. This line of crosses will therefore be discontinued. The hybrids resulting from this cross were of two types—those that in growth and in leaf resembled the salmonberry and those that in growth and in leaf resembled the raspberry. The former are vigorous enough, but produce little or no fruit, and the fruit that is produced has no particular merit. Plants of the second type are weak and puny, producing but little fruit, and that inferior to the common varieties under culture.

Raspberry-thimbleberry.—Crosses have been made between the raspberry and the thimbleberry (*Rubus parviflorus*) and some plants

produced from the cross. They have not fruited, but it is hoped that they will prove to have more merit than those above referred to. The thimbleberry as it grows here is more ornamental than useful. It has very large light-green leaves; its fruit, however, is small and of little merit. The hybrid plants are therefore being watched with interest.

Seedling gooseberries.—Gooseberry bushes raised from seed produced at this station fruited abundantly in 1915. A few of the best of a large number of these seedlings have been selected for propagation and future test. The fruit is not remarkable in either size or quality, but the plants excel in productivity, which may give them special value. It is true that last season all cultivated varieties also bore abundant crops of fruit. It will therefore take one or more years to determine whether the seedlings will bear better in unfavorable seasons than the original plants.

Cranberries.—Many inquiries are received concerning cranberry culture. Some of the newcomers are of the opinion that the boglands of Alaska ought to be especially well adapted to cranberry culture. All efforts to grow the eastern cranberry in Alaska have proved failures. Several times small lots of plants of the cranberries which are generally grown successfully all over the States have been procured, but these plants have so far never done more than maintain a precarious existence, and many have died the second or third year. They have never fruited. The summers are apparently not warm enough to make this plant a success. Special efforts will be made to secure a hybrid between the cultivated cranberry and one of the species of Vaccinium indigenous to Alaska. The native cranberry often referred to in these reports is of excellent quality, but the fruit is small. The plant is only 4 or 5 inches high, and the yield of fruit, of course, very light. Nor is the plant very amenable to culture. It does better in its native habitat, surrounded with sphagnum, and crowded by several other plants peculiar to the swamp, than it does when transplanted to good soil. There is therefore no likelihood that this species can be put under cultivation with profit.

Blueberries and huckleberries.—There are several species of blueberries and huckleberries (Vaccinium) indigenous to Alaska that undoubtedly would be of value if they could be brought under culture. All of them require a sour, peaty soil in order to grow at all. Attempts to transplant them to good garden soil have invariably proved failures. Seed has been selected from bushes that produce exceptionally large berries, and young plants have been raised. In due time attempts will be made to cross these species and varieties, but as yet there is nothing to report on the subject.

Apple seedlings.—Crosses have repeatedly been made between the native crab apple, which is quite abundant in the region about Sitka,

and the early summer apples which are now fruited every year at the station. Only a small percentage of these crosses have proved to be a success. Some seedlings have, however, been raised, and to prove their value they will, when large enough, be grafted to larger trees with a view to shortening the time for fruiting.

FRUIT TESTS.

The station is testing, on a small scale, a number of varieties of apples, cherries, and some plums. These tests will be continued. Promising varieties are constantly being added to the test orchards, while others that have proved unsuited to the conditions have been discarded. In favorable seasons like that of 1915, both apples and cherries of very early-maturing sorts can be successfully grown. To avoid repetition, the reader is referred to Mr. Anderson's notes, page 29.

Apples.—The Yellow Transparent apple was a real success the past season, and so was the Livland raspberry and the Whitney crab to only a slightly less degree (Pl. I, figs. 1 and 2). Many of the station trees were loaded with fruit which attained almost normal size and was of fair quality.

The writer saw a Yellow Transparent apple tree in Juneau loaded with fruit. It had originally come from this station, and it would compare favorably with similar young trees in any section of the country. It is proper to state, for the benefit of settlers who are anxious to raise fruit, that it is useless to plant anything but the earliest summer varieties that are grown in the States. Fruit that ripens in the Middle West later than July, or, at the latest, the very beginning of August, is not suited to Alaska. Summer varieties in the States are fall varieties here, and fall varieties in the States will not mature at all in Alaska. The first point to be considered in importing trees for planting is the season of ripening. The Yellow Transparent, as far as now known, is the best apple, that is, the one giving the best promise of success in southeastern Alaska, and next to that is the Livland Raspberry apple. They are the only two that can be recommended at this time. The coming spring there will be added to those now under test several other summer varieties, some of which it is hoped may also prove valuable.

Cherries.—So far only the so-called sour cherry has proved of any value as an orchard tree, and in most seasons even the varieties of this class are more or less a failure. The past season, however, all of the four sorts growing in the test orchards did fairly well. They are the Richmond (Early Richmond), Morello (English Morello), Ostheim, and Dyehouse, of which the Early Richmond takes the lead. Several other varieties will be added to this list the coming spring,

including also some sweet cherries. The experience with cherries in the past has been that most of the blossoms failed to set fruit. This is due to two causes—an absence of insects, particularly bees, to aid fertilization, and rainy or stormy weather, which frequently occurs in the spring during the blossoming season. When the weather is fair, as it was the past year, the trees will set fruit moderately well, but even then much of the fruit, both of apples and cherries, drops before reaching maturity. It is also noted that both apples and cherries are more apt to crack in this climate as they approach maturity than those grown farther south. There is a vast amount of work to be done in the development of these fruits before it will be possible to pronounce tree fruits a success.

Bush fruits.—Raspberries, currants, and gooseberries, the three leading varieties of bush fruits, are a magnificent success throughout southeastern Alaska, and this success is only slightly diminished toward the westward and inland. In the interior they do not always succeed. A frost may kill the blossoms, or an unusually severe winter cut down the growth or weaken the bushes. But speaking generally, these three classes of bush fruit are a success throughout Alaska.

The raspberry and the currant are indigenous up to and beyond the Arctic Circle. Every settler taking the trouble to plant the bushes can raise all the fruit he will want for family use, and in many cases for market when a market can be found.

DISTRIBUTION OF NURSERY STOCK.

The Alaska stations aim to help and encourage the settlers whenever possible, and with this end in view, and also for the purpose of ascertaining the value of given varieties of fruit in other sections of the Territory, the Sitka station maintains a small nursery for the propagation of all sorts of fruit that give any promise of being of value, each year distributing trees and bushes as far as supplies are available. This distribution is made free of charge. All that is asked in return is that the plants and trees shall be properly cared for, and that report be made to this station as to successes or failures with the stock supplied. One hundred and twenty-six applications for nursery stock were received last year, and stock was sent that was deemed best suited for the respective regions. It is most difficult to send packages of live plants to distant interior points, because packages of this character have to await the opening of river navigation, which does not usually occur until some time in June, and also because such packages are frequently unduly delayed at transfer points, with the result that when the plants arrive at their destination most of them are dead. With

the present means of transportation this is probably unavoidable, but it is hoped that this difficulty will be overcome when the railway is completed.

THE ROOT-MAGGOT PEST.

The larvæ of at least one, and possibly more, species of insects have become so destructive all over the Territory that they fall but little short of being veritable pests. A root maggot attacks all of the vegetables that belong to the important family of Cruciferæ, to wit, turnips, radishes, rutabagas, cabbage, cauliflower, and kale. Some settlers also report that they attack beets and potatoes. No practicable remedy has so far been discovered; that is, remedies that are found to be effective are too expensive to apply, except on a very small scale. A remedy which has proved of value is a strong decoction of tobacco, and tobacco, not being an Alaska product, is rather expensive. Of course the poorest and cheapest grade will answer. Tobacco stems, when they can be secured, cost less, and yield the poison as well as manufactured tobacco. Boil a pound of tobacco in 5 gallons of water for half an hour, and dilute by the addition of 5 more gallons of water; then apply to the ground with a sprinkler. It is well to sprinkle the leaves also to kill any hatching larvæ. Apply so thoroughly that the maggots already in the roots will be killed.

FAIRBANKS STATION.

Fairbanks Station is operated as a demonstration farm. The station is not undertaking any grain breeding, and with few exceptions the crops are grown on a field scale. The object is not only to test many varieties thoroughly under field conditions, but also to demonstrate the best practice in farming for that region. This work was continued during the past season.

GRAIN CROPS.

The season was very early, resembling in that respect that of 1912. Seeding began May 4 and was completed May 18. This early seeding gave the grain an excellent start, but the early part of the summer was very dry. Practically no rain fell during June, as was the case at Rampart, with the result that at both stations short straw was produced, but the heads were good, with plump kernels, and all crops not only matured, but matured very early. There was harvested 50 bushels of spring wheat, 900 bushels of oats, 200 bushels of barley, 5 bushels of buckwheat, and a few bushels of spring rye, together with smaller amounts from plat work. Finnish Black oats, the leading variety, yielded 42 bushels to the acre; spring wheat,

40 bushels to the acre; and barley about the same. These yields would have been almost doubled if the rainfall during the growing season had been normal and not too excessive during the harvest. It rained almost continuously during August and September, and a considerable percentage of the grain sprouted in the shock before it could be saved, but, in spite of these unfavorable conditions, the showing is very creditable.

In addition to the grain, 260 pounds of Petrowski turnip seed was raised. In a comparative test of several varieties tried practically all over the Territory for several years, the Petrowski turnip proved to be by far the most popular. It is less subject to root maggots than other varieties, and is a good yielder of fairly uniform size and good flavor. The Alaska stations will plan to distribute home-grown seed of this variety liberally to settlers in the Territory who may call for it.

Winter wheats were a failure. Out of the several varieties tested none made a stand in the spring that justified their occupying the ground. A few came through the winter with a light stand, as did also three varieties of winter rye, but these were all killed by freezing, heaving, and thawing during the spring before growth began. This experience emphasizes the fact that varieties which are partly hardy like the Kharkov are frequently killed by the alternating freezing and thawing of the ground in the spring as the snow leaves. Whenever the snow remains on the ground until settled weather begins, then a winter grain crop may be raised. This fact suggests that winter grains should be sown in places where the snow is deepest and where it remains longest in the spring.

One of the Russian varieties of spring wheat obtained from the experiment station at Irkutsk has done well at Fairbanks Station for two years. It was received under the label H. G. and is very similar to the Chogot. This variety will be seeded on a larger scale next year. Gesselberg spring rye is a variety that was also obtained from the Siberian experiment station, and it matured at Fairbanks better than it did at Rampart.

An experiment was tried last year at this station in sowing spring grains in the fall just before the ground was frozen, in order that they might be in the ground ready to start as soon as spring began. This experiment was suggested from the frequently excellent stands of volunteer grain. It proved to be a failure, the seed rotting in the ground, and in the spring there was only a small percentage left that could germinate. The fall seeding of spring grain can not be recommended as a general practice.

Attempts at growing winter grain will be continued, however, in the hope of learning more about these crops. On July 14, 1915,

12 varieties of winter wheat and 5 varieties of winter rye were seeded, all of which developed fine root systems before the freezing of the ground.

Mild weather continued late in 1915. Plowing was continued until October 12, when it was finally stopped by frosts.

ALFALFA.

The Siberian varieties of alfalfa have not been grown at Fairbanks heretofore for lack of seed, but the station has, on the other hand, sown plats of several strains of common alfalfa. These have invariably been winterkilled and the 1915 crop was no exception. Grimm and other strains were dead in the spring. A few hundred plants of the Siberian strains survived, scattered through the plats. These were transplanted to rows, so that the plants could be studied individually. The early dry weather retarded the growth of these plants and none of them matured seed. The plan is to first establish selections at Rampart, and from the seed produced there grow those varieties that proved hardy on a larger scale at both Rampart and Fairbanks stations as far as the seed production will permit.

Red clover seeded in the spring of 1915 attained a height of 2 feet and bloomed profusely. Some seed set, but failed to mature before frost, which has often happened in former years. Red clover must be treated as an annual. It will afford an excellent pasture and some hay during the first season, but it never survives the winter, and must be sown afresh every year.

The little garden work that was undertaken was a success, as it always is in the region about Fairbanks. The most important feature of this work was that tomato plants, started in the house but set in the open ground in the beginning of June, set an abundance of fruit, a large percentage of which matured without protection. The tomato is a tender garden vegetable, and that it should actually mature fruit out of doors in latitude 64° 50′ is one of Alaska's agricultural phenomena that deserves special notice.

THE FAIR.

The town of Fairbanks has held an agricultural fair in the beginning of September for several years past. The exhibits have constantly improved in number and in quality from year to year, and last year they were better than ever. There was keen competition among many exhibitors for the prizes offered. The Fairbanks Station was invited to join in the display and did so, but did not compete for prizes.

POTATOES.

The farmers of the neighborhood are fully able to supply the local potato market, and they raised a large and excellent crop last year. It was estimated at 900 tons.

Fifteen varieties of potatoes tested at the station covered 3½ acres of land, 40 per cent of which was on the north slope. The produce was 18 tons. Most of these potatoes will be used for hog feed, and some will be distributed for seed to those who may want them. Potatoes will be grown still as one of the crops in a three-year rotation with grain, as cultivating the potato crop is equivalent to a season of summer fallow. A limited area will also be planted in variety tests. The variety tests of last year were made on south-slope land of uniform quality, and by actual weight, based on the area occupied by each variety, the 10 best sorts yielded in the following order: Gold Coin, Eureka, Beauty of Hebron, Irish Cobbler, Burpee's Early, Extra Early Pioneer, Noroton Beauty, Early Market, Michigan Early, and Ohio Junior. Gold Coin is a large, late potato, which, however, is not of first-class quality, but in a dry season like that of 1915 it matures perfectly and easily takes the lead in yield.

TURNIP SEED.

An attempt to grow Petrowski turnip seed will again be made in the summer of 1916. About 200 bushels of roots grown last year are now in the cellar ready to be planted for seed in the spring.

HOGS.

As stated in the last report, the station has a start in pure-bred Duroc-Jersey hogs. They did not do so well as could be wished. One of the young brood sows died a few months after being brought to Fairbanks, and the pigs that were farrowed in the middle of the summer of 1914 all died during the winter. They were attacked with what appeared to be rheumatism, becoming lame and growing rapidly worse, until finally every muscle in the body seemed to be paralyzed, so that they could not get up and had to be fed by hand. Pigs which were farrowed in the spring of 1915 did fairly well, however, during the summer, and in November, 1915, when this report was written, the station had 25 head, 5 old hogs and 20 shoats. The best four or five of the young stock will be kept for breeding and the remainder sold if a market can be found. As several farmers keep hogs, the market is pretty well supplied. The station will, however, continue to raise the pure-bred stock and to supply farmers with breeding stock whenever there is a demand. Estimating the grain feed consumed at a market price of approximately $90 a ton, whether

purchased or produced on the farm, it is probable that the hogs will for a time be raised at a financial loss. The work with hogs is being conducted to ascertain whether or not pure-bred hogs can be maintained at their recognized standard of excellence under conditions that prevail in the interior and to learn the best methods of handling hogs under those conditions.

IMPROVEMENTS.

Improvements during the year consisted in supplying the station with 150 rods of rabbit-wire fencing and in replacing the worn-out roofing on the cottage and on a portion of the barn with corrugated-iron roofing.

No clearing was done, owing to lack of funds, except to finish the stumps on a few acres partly cleared and to put this land under cultivation.

DISTRIBUTION OF SEED GRAIN.

It is the plan to distribute the surplus grain raised at this station to the farmers of the interior, free of charge, in lots of 2 and 3 pounds, for the purpose of introducing the varieties that have been found satisfactory. Those who desire such samples should address the assistant in charge of the Fairbanks Experiment Station, Fairbanks, Alaska. Such samples will not be sent out of the Territory, and they will not be supplied free of charge in lots exceeding a few pounds in weight.

HARDY CATTLE FOR THE INTERIOR.

The writer renews his request for authority to undertake the development of a hardy bovine for interior Alaska. It has been pointed out in former reports, and especially in that of 1914, that the yak is an exceedingly hardy animal, and that crosses between the yak and common cattle can be rather easily made. We have a hardy race of common cattle in the Galloway, and need only a few head of yak to begin the experiment. The Fairbanks Station naturally lends itself to this purpose, and it is recommended that the experiment be undertaken there. Interior Alaska needs a breed of cattle that can withstand the extreme cold and live through the winters under the treatment and care ordinarily given. The writer is of the opinion that such a breed can be developed by an infusion of yak blood in cattle like the Galloway.

For a more detailed account of the work at the Fairbanks Station see page 42.

RAMPART STATION.

The northernmost experiment station is located at Rampart, on the banks of the Yukon, in latitude 65° 30′ N. It is devoted chiefly to the testing and breeding of grains and legumes. This work is

being done so far north because it is believed that varieties originated and successfully produced in the latitude of Rampart will succeed in all parts of the Territory south of the Arctic circle. Potatoes are also tested at this place, and other hardy vegetables are grown on a very small scale. The process followed with the grains and legumes has been to secure the earliest varieties obtainable that can mature between frosts, and then use these early strains in pollinating later and more productice varieties. This cross-breeding has gone on for several years. The work is just beginning to give results which promise to be valuable.

ALFALFA.

It is of the utmost importance that a leguminous plant should be found, or developed, which shall be thoroughly adapted to the climate. The station has been working with alfalfa for several years. A variety of common alfalfa known as Grimm was thought to be hardy until a large percentage succumbed during the winter of 1914–15. The yellow-flowered *Medicago falcata* alone proved to be entirely hardy. It was a disappointment to have the Grimm winterkilled, as it was thought to be well established. Compared with *M. falcata*, the Grimm is the more valuable in that it has a more upright habit, larger leaves, and greater vigor. To combine this vigor of the Grimm with the hardiness of *M. falcata*, reciprocal crosses have been made between the two species, and the seed will be planted in the spring of 1916. Chance crosses have also occurred in Grimm grown in close proximity to *M. falcata*. Grimm raised in this way the past season was found to have produced a few plants which partook of the nature of both species. While they had the general habit of the Grimm, the flowers were of varying shades of green, yellow, and purple, and the pods of falchion shape like *M. falcata* pods, while the true Grimm has spiral pods. Pod variation occurs, however, in both species, and whether such variation is due to climate, to sports, or to chance crosses, can not be determined at this time.

In this breeding work it is essential that individual plants be studied and advantage taken of any slight variation in favor of an improvement. For this reason a considerable portion of the alfalfa seedlings are transplanted into rows 2 feet apart and the plants grown in such a manner that each one can be readily made a subject for study.

This work is of very great importance and rich in potentialities. When a perfectly hardy and vigorous variety of alfalfa is produced, suited in all respects to the climatic conditions of interior Alaska, one of the problems of placing agriculture on a solid foundation will

be solved. The culture of legumes is second in importance only to the production of grains. Indeed, grains can not be successfully grown in interior Alaska for more than two or three years in the same soil unless this soil is renovated and fertilized by the addition of nitrogen.

VETCHES.

Alaska is not wholly dependent on alfalfa, as it is believed that vetches can also be grown successfully. The season of 1915 a plat of bird vetch, *Vicia cracca*, made an excellent growth, and it produced seed freely. It will be tried on a larger scale hereafter. Last season was unusually favorable to all crops, and possibly it may not continue to make an equally good showing. It is to be noted, however, that while the winter was trying to alfalfa, this vetch survived in excellent condition and made a heavy growth. Variations in this vetch were found in size of foliage, character of stem, and method of fruiting. The study of varieties and the selection and propagation of the most promising will also be followed up in future work with this crop.

WORK WITH GRAIN.

Certain varieties of barley and oats have been successfully grown at this station from its establishment. The varieties of spring wheat worked with until recently have not always succeeded, nor has a hardy variety of winter wheat yet been found. A Russian variety, introduced a number of years ago by the United States Department of Agriculture and known as Kharkov winter wheat, is the hardiest tried up to the present, but it has given a stand of only 5 to 10 per cent each spring; and it is an important point to note that this 5 per cent stand which proved hardy did not give a better stand the following year. In other words, hardiness can apparently not be bred into a grain by selection. De Candolle noted this fact many years ago in his work on the origin of cultivated plants, and the work at Rampart has so far failed to disprove his statement.

The varieties of spring rye worked with have generally been failures. Spring rye requires an even longer growing season than spring wheat, but winter rye of many varieties has done well. Rye is hardier than wheat, and in winters during which wheat was killed rye has come through with an almost perfect stand.

Now, it is to be noted that all early-maturing spring grains are normally of short growth with small heads, being poor yielders in comparison with later varieties. The work with grains, therefore, is carried out for the purpose of developing varieties which retain the quality of earliness and at the same time have the vigor, large heads, and good yielding qualities of the later varieties. The surest way

to do this is by crossing two varieties, each of which has one or more good qualities which it is desirable to combine.

Barley.—The cross-breeding work with barley was begun several years ago. Barley is destined to be perhaps the most important grain crop for interior Alaska, as it is especially adapted to northern latitudes. It matures early, it is a good yielder, and it has a nutritious grain, which is not only an excellent food for live stock, but can be, and in northern Europe is, largely used as a food for man. The early barleys are small, giving a poor yield. The Pamir, a variety grown on the high plateaus of central Asia, is a type of this class. Its only desirable quality is its earliness. It will mature in 70 days, more or less, depending on the season. This variety was used as the male parent in crossing on several later kinds, and other early varieties were also used. Earliness is the first consideration, a stiff straw the second, and then a large, well-filled head, and, lastly, the elimination of beards, which are objectionable, particularly when the crop is grown for hay and also in the ordinary handling of the grain. Four of these early hybrids, which have now become stable, will be propagated in increased plats for further study, and if they continue to prove worthy, will be distributed to a limited extent. These hybrids will all ripen by the middle of August. All are six-rowed, with large, well-filled heads, and three of them have no beards. Two of the beardless and one bearded cross are hull-less Many others are in the process of development.

Oats.—In point of importance oats will probably rank second as a grain crop for interior Alaska. Of the large number of varieties grown at this station there are three or four which are quite satisfactory. One of these is the Finnish Black, which has been described in several former reports. This is placed first because of its earliness, vigorous growth, and fair-yielding qualities. It has a stiff straw and stands up well in storms. Other good oats are the South Dakota, the Copperfield, and the Norwegian. Crosses are under way which give promise of being useful, but as yet none of them has become established. A hull-less oat was grown for the first time at this station last summer. As it proved to be late in maturing, it has no value in its present form.

Wheat.—Two years ago small samples of several varieties of grains were obtained from the director of the experiment station at Irkutsk, Siberia, and among them were several varieties of spring wheat. These Siberian varieties promised to be of value to Alaska, not indeed in their present form, for they are small and poor yielders, but for the purpose of hybridizing our larger and later varieties. Two of these Siberian wheats, namely, Chogot (No. 133) and Irkutsk (No. 134), have been crossed, and three first-generation hybrids are

under observation. The Chogot produces small but very hard kernels of red wheat, and it is the earliest spring wheat so far grown at any of the stations. It ripened in 88 days from seeding.

Rye.—Among the plants of one of the varieties, No. 281, was found a single plant on which all the heads formed clubs. As these heads produce an average of more than twice the number of grains produced by normal heads, an effort will be made to perpetuate this character. As noted, winter rye is hardy when protected by a good covering of snow, and since the average snowfall is from 2½ to 3 feet it is reasonably safe to count on a crop of winter rye. But with this grain also it will be necessary to produce a variety ripening in the latter part of July, or at least two weeks earlier than the earliest now grown. Winter rye must be seeded the last of July or the very beginning of August in order to develop a good root system before cold weather, and varieties that do not mature before the date of seeding must of necessity be held over a year before they can be sown. As has been noted, spring rye is later than spring wheat, and when winter rye is a fairly sure crop there is no reason for growing spring rye.

Buckwheat.—Buckwheat has been grown for a number of years and never failed to mature seed even in unfavorable years. It is rarely the case that all the seed will ripen, but a good percentage of it may be counted on to mature.

MISCELLANEOUS WORK.

Among the crops of less importance are potatoes, strawberries, and other small fruits, and the usual line of hardy vegetables. Experiments with the potato were made during the season to ascertain the results from planting single eyes versus whole potatoes, and the results are conflicting. The chief value of the potato work is to make comparative tests of varieties which will do well in this climate. It is impossible to get seed potatoes into the interior during the winter in time for spring planting, for they freeze en route, and it is equally impossible to keep seed potatoes over a whole year. Hence the practice has been to grow new varieties of potatoes at the Sitka Station for one or more years, dig those that are early enough in the latter part of August, and forward small quantities to Rampart and Fairbanks stations by parcel post before river navigation closes. They are then kept in a frost-proof cellar until spring. Some varieties are sensitive to climatic conditions, that is, a variety which does well in one season may rank higher or lower in a comparative scale in the next year if the seasons differ in rainfall and temperature. The varieties that do best at Sitka Station do not always prove to be best for the interior, neither will the same variety keep the lead

year after year at either station. The Irish Cobbler is about as satisfactory as any potato grown. Burpee's Superior has also proved satisfactory. Other early, desirable varieties are Six Weeks, Late Puritan, Bliss's Triumph, and Early Harvest.

Some hybrid strawberries were grown at Rampart Station in 1915. The plants were produced at the Sitka Station and were crosses between the wild species and the Hollis. The important feature is that they are hardy at Rampart. The berries are not so large or the plants so vigorous as they are at Sitka, but nevertheless they make it possible for the farmers in the interior to raise strawberries of good flavor and fair size. Better varieties for the interior are expected from the crosses that have been made with the interior wild berry.

The first apple tree that, as far as known, has ever bloomed in the interior is a Siberian crab brought to this station from Sitka Station 10 years ago and now forming a bush between 3 and 4 feet high, with a spread of 5 to 6 feet.

The work of the Rampart Station is described in detail in this report. (See p. 54.)

KODIAK STATION.

The dry weather from which the interior stations suffered also affected Kodiak Station. As a consequence hay and silage crops fell short of the estimate. The pastures, though short, were enough to keep the herd in good condition. The rains set in in early August and were so continuous that 25 tons of hay was spoiled and much of the silage was put in in poor condition. In spite of these drawbacks, it is estimated that there will be feed enough to carry the herd through the winter. One hundred and seventy tons of silage was put in the silos.

THE HERD.

At present there are 58 head in the herd, of which 28 are old cows, 12 heifers, and 6 heifer calves. Two are 3-year-old bulls, and the rest young bulls and bull calves, some of which have been steered. They are all doing well. Occasionally an animal is lost through an affection of the liver, but losses from this cause are not serious, and with the exception of the cases of impaction, which occurred several years ago, this liver trouble has been the only disease attacking the herd.

DAIRY WORK.

The best milking cows were brought to Kodiak from Kalsin Bay, placed in the dairy barn, and treated as dairy animals. Never having been regularly milked before, they did not take kindly to this process. Only five cows were finally retained for the dairy work. The milk was tested for butter fat, but no attempt was made to make butter or

cheese, for the reason that the dairy equipment needed for that purpose did not arrive until fall, nor was the dairy building in condition for work until the latter part of the summer. The milk was fed whole to the calves. A determined effort is being made to educate calves and heifers to become accustomed to constant handling. The Galloway has been bred as a beef animal for upward of two centuries and a half. The cows have suckled their calves and have run at large summer and winter, being fed only during seasons of heavy snow or insufficient pasturage. This method of handling has developed a shyness which is inherited by the young even after they have been subjected to closer contact with herdsmen for generations. By persistent work this nervousness or shyness can be overcome, and it is being overcome at the station.

Alaska needs an all-purpose animal. Inquiries for cows nearly always stipulate that they must be good milkers. There is no doubt that dairying qualities can be developed in the Galloway, but it will take too long to do it. What is thought the best solution of the problem is to make a cross with a dairy breed, the Holstein-Friesian breed having been selected, all things considered, as most available for the purpose. Other breeds merit consideration for such a cross, as the Brown Swiss, the Red Polled, and the milking Shorthorns, but none of these are readily available. The Holstein-Friesian takes high rank in milking qualities and is a healthy and fairly hardy breed. It is, therefore, desired to obtain 5 or 6 cows and a bull of this breed in the summer of 1916 and add them to the dairy herd at Kodiak. Reciprocal crosses then may be made between these and selected Galloways. It is desirable to retain the Galloway characteristics and rustling powers as far as this may be possible, but to add to them a larger frame and better milking qualities. From these crosses it is believed a distinctive Alaska breed can be developed which shall possess the ideal qualities of a hardy, dual-purpose, black, hornless cow.

THE SHEEP.

The flock was greatly reduced by the depredations of the brown bear a year ago, however, the 14 ewes that remained dropped 14 lambs in the spring of 1915, 7 of which were ewe lambs. This small flock has been doing well with very little attention. To protect them from bear, they were placed on an island, where they maintained themselves in most excellent condition. It is hoped that the bear menace may be remedied by legislation. When the flock will again be safe in its pastures at the station, another purebred ram should be procured to replace those lost, and the process of breeding large-framed, long-wooled sheep should be continued. It has been demonstrated beyond question that sheep do well on the native pastures

throughout the region, and that in normal winters they can maintain themselves with little feed.

RESTORING PASTURES.

The work of restoring the pastures on the volcanic ash has been continued, but, on account of the dry summer, with only moderate success. However, there is steady progress in this work. The writer visited the station in the summer of 1915 and found that most of the grasses that have been seeded maintained themselves. It has been found that of those in the mixture seeded there are three grasses that are doing particularly well—Rhode Island bent grass (?), sheep's fescue, and redtop. These are found where the coarser grasses have died out. White clover has become established in spots, but not so uniformly as could be desired. Red clover has not done well, though occasional plants may be found. A little common alfalfa made a thin stand in spots. No seed was available of the hardy alfalfas growing at the interior stations, and they have, therefore, not been tried. The work confirms the judgment expressed at the start that a nitrogenous fertilizer must be added to the volcanic ash in order to produce growth. The work also proves that there is no better fertilizer for this purpose than common farmyard manure, which, for grass seeding, should not be plowed in, but worked into the surface with a harrow or a shallow cultivator. This will enable the grass roots to take hold by the aid of the manure. The work also proves that in lieu of a fertilizer of any kind it is sufficient to turn up a few inches of the black soil underlying the ash, but in most places where the native grasses do not reassert themselves the layer of ash is too deep to make it practicable to turn up any of the black soil by ordinary methods of cultivation. A special gang plow was constructed which can be run 20 inches deep, but it is of so heavy draft that with the available teams it is not possible to go over large areas.

Norwegian nitrate of lime, which has been purchased as a source of nitrogen for the volcanic ash, is found to be a good fertilizer, of value, however, only when the seeds have germinated and the little grass plants are able to make use of the nitrogen. It is so readily soluble that with each rain it is carried through the ashes to a depth too great for the young roots, but after the grasses are started it is an excellent fertilizer. One of the difficulties to be contended with in reestablishing grasses is that the fine ash drifts as readily as road dust on a summer day. Even light breezes will lift clouds of ashes from the surface, leaving the tender grass roots exposed. In this work of restoration of the grasses, there is present a valuable ally in the fireweed (*Epilobium angustifolium* and *E. latifolium*), the downy

seeds of which are carried everywhere, lodging and growing readily in the ash. In a short time the sturdy plants afford to the seedling grasses protection from both wind and sun, and when the weeds die, the fallen stems help to retain the drifting ash and add humus to it. The work of restoration is well under way, but by no means completed. On the steepest slopes and hillsides the ash had practically all disappeared, and the native grasses are more luxuriant than ever. On the other hand, the layer of ash has increased in thickness on the level lands from which the heaviest crops of native grasses for hay and silage were formerly cut, and it is here that the problem of establishing the cultivated grasses is being worked out.

CHEMICAL ANALYSIS OF ASH.

Through the kindness of Prof. Elton Fulmer, head of the department of chemistry, Washington State College, Pullman, Wash., there is presented herewith a chemical analysis of this volcanic ash made under his direction.

Analysis of volcanic ash.

	Per cent.
Loss on ignition	0.65
Silica (SiO_2)	72.16
Ferric oxid (Fe_2O_3)	2.85
Manganese oxid (MnO)	0.41
Titanium oxid (TiO_2)	Trace
Alumina (Al_2O_3)	13.25
Lime (CaO)	3.80
Magnesia (MgO)	0.47
Soda (Na_2O)	3.86
Potash (K_2O)	2.48
Sulphuric acid (SO_3)	0.20
Total phosphoric acid (P_2O_5))	0.36

REMARKS.—The ash is highly magnetic; in all probability some of the iron present is magnetic.

On the whole, the fall of volcanic ash will benefit the country. The gardens about Kodiak are better now than before the ash fall. Wherever the ashes can be mixed with the original soil vegetation of all kinds grows more luxuriantly than before. The same will be found to be the case on the station pastures when, in course of time, the ash shall have been incorporated with the soil by deep cultivation or humus added to it by decaying vegetation.

IMPROVEMENTS.

A number of improvements were made at the Kodiak Station during 1915. Two hundred and forty rods of fencing was built to replace that which was buried by the ash. The cattle barn at Kalsin

Bay was reconstructed internally to give stanchion room for more animals. One room 16 by 20 feet was added to the cottage at the bay, which now has three rooms altogether, and a room 16 by 16 feet was added to the dairy building at Kodiak. A machine shed 24 by 30 feet was built; also a calf barn 16 by 20 feet. A 5-ton wagon scale and a large number of dairy utensils were added to the equipment. The gasoline boat *Red Wing*, 48 feet long, purchased for the run between Kodiak and Kalsin Bay, is a safe boat for this stretch of water, which is frequently very rough and dangerous for small boats. A start was made in painting the buildings, but only about one-third of the work was finished.

CHANGES IN PERSONNEL.

Mr. Hiram E. Pratt, B. S., a graduate of the Oregon Agricultural College, Corvallis, Oreg., entered the Alaska service as assistant at Kodiak Station in July and took charge of the breeding work at Kalsin Bay, succeeding Mr. C. W. Heideman, who resigned. Mr. J. Carl Laney, B. S., a graduate of Washington State College, Pullman, Wash., was appointed as assistant at Kodiak Station at the same time and has taken up the dairy work in place of Mr. Laurence Kelly, resigned.

BREEDING OF HORSES.

There is no doubt whatever that the breeding of horses would succeed at this station. At present no horses are bred in Alaska. They have to be imported from the States at a high cost for freight. It would appear to be proper work for this station to undertake horse breeding for the same reasons that it has undertaken the breeding of cattle and sheep. There will be an increasing demand throughout Alaska in the near future for a type of sturdy draft horse suited to the climate; in fact, this demand has already begun. And while the station can not hope to supply this demand, it can take the lead in showing how it may be supplied from Alaska-bred horses.

The foregoing account is largely condensed from the report of the assistant in charge of the Kodiak Station. (See p. 69.)

AN AGRICULTURAL RECONNOISSANCE OF MATANUSKA VALLEY.

Mr. M. D. Snodgrass, assistant in charge of the Kodiak Experiment Station, was detailed to make an agricultural reconnoissance of the Matanuska Valley and to select a site for an agricultural experiment station in that valley. Mr. Snodgrass spent a part of the months of May and June in this task, traveling over a considerable portion of the valley. He examined the soil in many places,

interviewed settlers, and took notes on crops and weather conditions. He reports that the prospects for successful farming in that valley are as favorable as probably anywhere in Alaska. His work was much facilitated by the courtesy of the Alaskan Engineering Commission, which extended to him facilities for transportation of his pack and equipment, and on occasion gave him the advantage of shelter in its construction camps along the projected railway line.[1]

The real task, that of selecting a site for an agricultural experiment station which shall be representative of the soil and climate of the Matanuska Valley, was also successfully accomplished. On the recommendation of the Alaskan Engineering Commission a tract comprising 12 sections of land located at the junction of the main line of the railway and the branch line leading to the Matanuska coal fields had been reserved for a town site and for junctional purposes. With the consent of the commission, Mr. Snodgrass located a tract of 240 acres in section 15 of this reservation for a station site, about 140 acres of which can be cultivated. The remaining 100 acres, consisting of sharp ridges and gullies, is adapted only for pasturage. The tract is located about 2 miles north of the junction above referred to and about 30 miles from the head of Knik Arm. As there had been an influx of homesteaders to this valley during the winter and early spring, all the best land had already been located, except the land in the reservation. This land constitutes a desirable location for an experiment station. It is close enough to the railway to give the station full benefit of easy transportation, the soil is representative of the region, and the tillable portion lies advantageously for experimental work. The region is well adapted to general farming and stock raising. There will be a large and constant demand in this region not only for demonstration of the best farming practices that experiment and experience have developed, but also for supplies of seed grain of various sorts and for the best types of cattle, sheep, and horses that can be developed in Alaska. The surplus young stock from Kodiak Station can advantageously be brought to Matanuska and bred for the benefit of the farmers in that region.

In order that there may be sufficient pasture land for the live stock which this station must eventually raise if it fulfills its mission, it will be necessary to enlarge the area now selected for that purpose. With the consent of the Alaskan Engineering Commission, it is recommended that section 14, which adjoins section 15 on the east, and which consists almost entirely of a series of wooded ridges and gullies, very little of which can be cleared and put under cultivation, be added to the reservation. If this section is not needed for

[1] A detailed account of this survey is given in Alaska Stas. Circ. 1 (1916).

the railway, it will be of great advantage to have it made part of the experiment station for pasturage. One of the very important tasks of the experiment station will be to breed pure-bred cattle, horses, sheep, and hogs, from which the farmers in the valley may learn which breeds of live stock are best adapted to the region, and where they can secure pure-bred animals for breeding purposes at reasonable prices.

NEEDS OF THE STATIONS.

The Alaska stations are in urgent need of some buildings and repairs in addition to those secured some years ago. On account of the isolation and the lack of suitable quarters that may be rented, the stations must supply houses for the members of the staff. At Rampart a cottage is needed for the plant breeder, who is now living in a log house badly in need of repair and situated at a considerable distance from his work. At Kodiak residences are needed for the superintendent in charge and for the dairyman. At Kalsin Bay a cottage is required for the animal husbandman. At present a three-room cottage is all there is for the animal husbandman and his family, one or two regular laborers, and from five to eight others at certain seasons, as at haying time, when the silos are being filled, etc. The plant-breeding house at Rampart should be completed and a small greenhouse erected at Kodiak for plant breeding and other work. About $10,000 will be required for these needed buildings.

At the Rampart and Fairbanks stations it has been the practice for several years to hire teams when the heavy work of plowing was done. On account of the cost of feed, this has been good economy, even when $12.50 per day was paid for team and man. With the development of the country and the railroad and wagon-road construction, the sources of temporary team supplies have been exhausted. There are said to be on the market several types of kerosene tractors, and one for each of the above stations would solve the present problem and be cheaper than the necessary teams and the feed required to carry them through the idle winter season. A 3 or 4 horsepower gasoline engine for driving the thrashing machine and to supply power for other purposes is needed by the Fairbanks station.

Some additional clearing and fencing at Rampart and Fairbanks should be done in the near future to admit of extending the cultivated area and to make possible more advantageous work in the rotation of crops.

GARDEN NOTES AT SITKA STATION.

By J. P. Anderson, *Horticulturist.*

APPLES.

Several varieties of apple matured fruit the past season. The best of these were the Yellow Transparent and Livland Raspberry. Trees of these varieties bore quite good crops, as did also the Whitney crab (Pl. I, figs. 1 and 2). Apples grown here the past season reached about normal size, but were more pointed and angular than the same sorts grown in a warmer climate. A variety which has been labeled Sylvan Sweet bore good apples, but they were not sweet. Other varieties that matured a few apples are Duchess, Hyslop, Keswick (Keswick's Codlin), Peerless, Tetofski, and two unidentified sorts, one of which was a crab and the other similar to the Wealthy, perhaps being that variety. The Patten (Patten's Greening) set a good crop of fruit, but did not mature before freezing weather. The quality of the fruit was good, but some sorts, especially the Yellow Transparent, showed some tendency to crack.

From the seed obtained in 1914, by crossing the native crab with cultivated varieties, only a few plants were secured. The work of crossing was continued this past season.

NURSERY STOCK.

Growing nursery stock for distribution has been continued and increased, as there are large numbers of new settlers coming into the Territory. The past spring there were sent out 261 apple trees, 640 currant bushes, 430 gooseberry bushes, 1,850 raspberry plants, 1,650 strawberry plants, besides Rugosa roses, basket willows, rhubarb, horse-radish, mint, and a few ornamentals. The stock available for the coming season includes 750 apple trees, 1,700 currant bushes, 1,000 gooseberry bushes, 1,850 raspberry plants, and other stock in proportion.

STRAWBERRIES.

The work on strawberries was carried on as usual. Numbers were applied to 988 seedlings, and of these some were rejected, while the greater part were left for another season's observation, when a very few of the best will be kept for further trial and the rest destroyed. The culling of seedlings kept over from previous years was continued. The seed resulting from the breeding work of 1914 was sown immediately and grown in flats, the plants being set in the field last spring. Numbers will be given these in 1916, and they will be kept under observation two years before selection for further trial is made.

CURRANTS.

Currants did not do their best this year, owing to the blossoms being attacked by a fungus. The crop was fairly good, however, especially of the red sorts. Some varieties set out in the spring of 1914 produced a fair amount of fruit, but others bore little. The Perfection seems to be by all odds the best red currant so far tried. Many of the berries were more than half an inch in diameter, with an extreme of nine-sixteenths inch. This variety is also productive. White Grape (Imperial White) seems to be superior to the other white varieties grown, while Lee (Lee's Prolific) has not yet been surpassed by other black sorts. Red currants added to the collection the past season were Holland (Long Bunch Holland) and Moore Ruby. Three varieties of black currants were also added—Naples (Black Naples), Black Victoria, and Wales (Prince of Wales).

Of the native species of currant grown at the station, *Ribes bracteosum* and *R. lacustre* fruited well. Others have failed to set much fruit. A variety of *R. floridum* has also failed to set fruit, though producing abundant bloom. The same is largely true of the ornamental species *R. alpinum*, *R. aureum*, and *R. sanguineum*.

As a result of the crossing work of 1914 the station now has a few vigorous seedlings of a cross between the garden black currant (*R. nigrum*) and *R. bracteosum*.

GOOSEBERRIES.

The Champion again proved to be the best all-round variety. The Whitesmith seems to be the best of the English sorts. Some of the English varieties are badly affected with mildew, while others suffer but little. The varieties set out in 1914 have not yet demonstrated their value, but Pearl seems very promising. Downing, Carmen, and Portage were added to the collection this season.

Nearly all of a lot of 359 seedlings fruited quite abundantly. Many of these were very good, a large number being of the Champion type. These will be kept under observation another year. Seven were selected for propagation for further trial.

RASPBERRIES.

As usual the Cuthbert bore a heavy crop of excellent fruit of large size. A number of other varieties at the station have not had a fair chance to demonstrate their comparative value the past two years. One variety of the European species (*Rubus idæus*), called the Orange, bears fruit of the very highest quality, but seems unable to properly maintain itself. Golden (Golden Queen) and St. Regis were added to the collection during the past season.

In 1914 the Cuthbert raspberry was crossed with the thimbleberry (*Rubus parviflorus*). A small amount of seed was obtained and only four plants secured. These made a moderately satisfactory growth the past season.

The sterility of the raspberry-salmonberry crosses seems to be due to the defectiveness of the essential reproductive organs of the flower. Of the few seeds obtained from occasional druplets which developed in 1914 none grew.

BLUEBERRIES.

The blueberries, especially the young seedlings, have made a rather slow growth. Of the 12 hybrid blueberry plants received in 1914 from Mr. F. V. Coville, of the United States Department of Agriculture, one showed bloom, but the fruit disappeared shortly before maturity. Seed was obtained from a wild plant bearing fruit much of which measured five-eighths inch in diameter. Also a red huckleberry bush was found with fruit from one-half to nine-sixteenths inch in diameter and some of the seed saved. The seed thus obtained was planted and has germinated.

CRANBERRIES.

The cranberry vines obtained from Wisconsin in 1914 made a fair to good growth the past season, but produced no bloom. The crop of wild berries was large. It is hoped that the eastern cranberry may produce flowers the coming season, as it is desired to attempt crosses between it and the native species.

CHERRIES.

Cherries bloomed abundantly, but set only a fair crop of fruit. Between the birds and the cracking and rotting of the fruit just before ripening scarcely any good cherries were obtained. The fruiting varieties were Dyehouse, Richmond (Early Richmond), Morello (English Morello), and Ostheim. The Morello set the most fruit. The following varieties have been planted the past two years, but have not fruited yet: May Duke, Montmorency, Morello (Wragg), Wood (Governor Wood), Baldwin, Spanish (Yellow Spanish). A tree of Napoleon (Royal Ann) in a private garden at Sitka bore a little very good fruit the past season.

PLUMS AND OTHER FRUITS.

The plums belonging to a native American species and their hybrids that have been tried at the station have been unqualified failures. A tree of Green Gage plum in a private garden in Sitka has

produced some fruit the past two years. A Prunus hybrid from Koslov, Russia, received from the United States Department of Agriculture Plant Introduction Field Station, Chico, Cal., in 1914, has made good growth and seems promising, but a cross between *Amygdalus nana* and *A. davidiana* from the same source has failed to survive. Scions of several early varieties of plums were received from the experiment station at Geneva, N. Y., but the grafts for some reason failed to grow.

The past spring 1-year-old trees were secured of two varieties of apricot, two of pear, and three of peach. These have made a fair growth.

VEGETABLES.

Potatoes.—Although the season in general was very favorable, some varieties did not yield so well as during the previous unfavorable season. This was partly due to the dying of the tops of some of the earlier varieties during August, whereas, during a cooler season, the tops of all varieties remain green until September.

The quality of the potatoes grown this season was in general very good, only a few varieties being from medium to poor in this respect.

In considering the yield the fertility of the soil should also be considered. The trial plat began with a strip of land that had been heavily manured the previous season, while on the opposite side it included a strip of hillside that was rather poor. In the table given below the varieties which show a notable decrease in yield were mostly from the poor side of the plat, while the previous season they were grown on better soil. The varieties showing a notable increase in yield are largely sorts grown for the first time in 1914 (Pl. II, fig. 1). All varieties were grown in rows 3 feet apart with 2 feet between the hills. This gives 7,260 hills per acre. For convenience the number of hills per acre was taken as 7,200, and this makes ample allowance for missing hills. Four varieties, Algoma, Earliest of All, Early Russet, and Netted Gem, were grown for the first time in 1915. They are not included in the list.

FIG. 1.—WHITNEY CRAB APPLE, SITKA STATION.

FIG. 2.—LIVLAND RASPBERRY APPLE, SITKA STATION.

FIG. 1.—SPAULDING NO. 4 POTATOES FROM TWO HILLS, SITKA STATION.

FIG. 2.—CELERY GROWN AT SITKA STATION.

Variety test of potatoes at the Sitka station.

Variety.	Color.	Yield per acre, 1915.	Yield per acre, 1914.	Variety.	Color.	Yield per acre, 1915.	Yield per acre, 1914.
		Bush.	*Bush.*			*Bush.*	*Bush.*
Admiral Dewey	White	528	240	Junior Pride	Light pink	235	325
Bliss Triumph	Deep pink	168	240	Keeper	Dark pink	312	326
Bovee	Light pink	155	138	Knowles's Big Cropper.	White	374	560
Burpee's Extra Early	White	252	206				
Beauty of Hebron	Light pink	250	126	LaFollette	do	163	120
Burpee's Superior	White	240	192	Livingston	do	28	75
California Golden Russet.	Russeted	317	282	Mammoth Pearl	Light pink	132	164
				May King	do	240	120
Clark's Alaska	White	240	300	New Queen	do	312	226
Clyde	do	346	175	New Snow	White	178	56
Columbus	Light pink	211	180	Norcross	do	221	234
Dakota Red	Dark pink	256	313	Northern King[1]	Pink	758	112
Early Beauty of Hebron.	Pink	182	272	Noroton	Light pink	115	487
				Norway No. 1	White	259	175
Early John	White	245	330	Noroton Beauty	Light pink	166	180
Early Fortune	Light pink	230	135	Olds's Prolific[1]	White	682	129
Early Ohio	do	139	164	Peach Blow	Light pink	216	205
Early Puritan[1]	White	552	171	Piqua Chief	White	148	208
Early Six Weeks No. 1.	Deep pink	108	109	Pride of France	Purple	228	280
Early Six Weeks No. 2.[2]	White	173	394	Pride of the South, or White Bliss.	White	158	112
				Red River Acme	Deep pink	82	88
Early Thoroughbred.[1]	Pink	470	91	Pure Early Rose	do	228	169
				Red River White Ohio.	White	106	111
Early White Albino[1]	White	557	146				
Epicure	do	216	166	Roosevelt	Pink	437	107
Extra Early	do	216	169	Rose of the North	Dark pink	230	197
Extra Early Ohio No. 1.[2]	do	206	334	Rural New Yorker No. 2.	White	346	204
Extra Early Pioneer.	White to pink.	144	336	Russian	Yellow	278	110
				Rust Proof	White	288	283
Extra Early Sensation.	Pink	288	84	Rusty Coat	do	264	168
				Scotch Rural	do	298	220
Extra Early Wahonsie.	White	211	80	Sir Walter Raleigh	do	216	120
				Snowhall	do	245	248
First Early	do	149	71	Snowflake Jr	do	221	76
Freeman	do	102	53	Spaulding No. 4[1]	Pink	696	171
Gold Coin	do	374	360	State of Maine	White	158	473
Good Times	do	132	188	Thorhurn	Light pink	194	217
Great Divide	Deep pink	158	257	Quick Lunch	White, pink eye.	110	92
Green Mountain	White	250	240				
Green Mountain Seedling.	do	283	.....	Uncle Sam	White	355	157
				White Beauty	do	274	240
Hamilton Early Rose	Deep pink	192	212	White Harvest	do	96	174
Happy Medium	White	89	83	White Ohio	do	226	120
Irish Cohbler	do	168	234	White Star	do	264	186

[1] These varieties were on a strip that had received a heavy fertilization in 1914.

[2] Probably not true to name.

Cabbage.—Thirty varieties of cabbage were grown, but the tests were rendered of little effect on account of the club root. Nearly every plant of every variety that escaped headed well, and some plants moderately affected developed fair heads. The plants evidently became infected in the seed flats. Autumn King seemed somewhat more resistant than most varieties. The heads were large and solid. Attempts to control the root maggot by the use of tarred felt squares placed around the plant when set out resulted quite satisfactorily.

Cauliflower and broccoli.—What has been said of cabbage is equally true of cauliflower and broccoli, except that the few plants of Purple Cape broccoli which escaped did not head well. Five varieties of cauliflower and three of broccoli were grown.

Brussels sprouts.—The same varieties of Brussels sprouts grown in 1914 were again tried. They seem much more resistant to club root than do cabbage or cauliflower, and all varieties did exceptionally well, nearly every plant producing a good crop of small heads or sprouts.

Kale.—Kale made a fine growth; so good, indeed, that it would be hard to conceive how it could have done much better. A plant of the Dwarf Curled Scotch variety was measured and found to have a spread of 42 inches. Tall Green Scotch was another variety grown. Kale seems much more resistant to club root than does cabbage.

Kohl-rabi.—Kohl-rabi seemed intermediate in its resistance to club root. Early Purple Vienna and Early White Vienna were grown and both sorts headed well. The growth was much better than in 1914, many heads growing to be 6 inches in diameter.

Turnips.—Sixteen varieties of turnip were grown. These varied a great deal in resistance to the root maggots, which constitute the greatest enemy to turnip growing in this region. The Early Red was ruined for market purposes, while the Petrowski was scarcely touched. The best turnip in quality is the Ostersundom (S. P. I. No. 33684), followed by the Petrowski.

Of all the varieties grown one stands out as of no value whatever. That variety is the Sweet German or Long White French. It was covered with fibrous roots and the yield as given in the table below is largely due to the earth held fast by these roots. All the turnips were planted June 7 and harvested early in October.

Variety test of turnips at the Sitka Station.

Variety.	Color.	Form.	Yield per acre.	Maggot injury.
			Pounds.	
Early Red or Purple Top Strap Leaved		Flat	13,100	Greatest.
Early White Flat Dutch Strap Leaved	White	Flat	28,500	Medium.
Extra Early White Milan	White	Flat	41,600	Less than average.
Extra Early Purple Top Milan		Flat	45,400	Do.
Golden Ball	Yellow	Flat	13,500	Do.
Long White or Cowhorn	White	Long	31,800	Great.
Bortfelder (S. P. I. No. 33682)	Light yellow	Long	30,100	Little.
Ostersundom (S. P. I. No. 33684)	Variable	Long	32,000	More than preceding.
Petrowski	Deep yellow	Flat	14,400	Very little.
Purple Top White Globe	White	Round	25,600	Great.
Red Top White Globe	White	Round	40,300	Do.
Sweet German or Long White French	White	Long	7,400	
White Egg	White	Oval	35,500	Medium.
White Globe Strap Leaved	White	Round	17,300	Great.
Yellow Aberdeen	Light yellow	Round	19,500	Less than average.
Large Yellow or Amber Globe	Bright yellow	Round	41,700	Do.

Rutabagas.—Rutabaga seed was planted early in May. In June the plants were so badly affected by maggots that it was deemed unwise to thin them. The maggots accomplished this, and it was somewhat surprising that the rutabagas should have yielded so well.

Many were irregular in shape, due to injury. The Monarch or Elephant was by all odds the poorest variety grown. All sorts were pulled October 8, and the yields per acre were as follows: Bangholm (S. P. I. No. 33687), 30,000 pounds; Breadstone, 19,300; Golden Neckless, 23,400; Improved Purple-Top Yellow, 42,700; Monarch or Elephant, 20,400; Purple-Top Yellow Globe, 37,500; and White Fleshed Neckless, 36,700 pounds.

Radishes.—The following varieties were grown: Chartier, Chinese Rose Winter, Cincinnati Market, Early Scarlet Turnip, French Breakfast, Giant White Stuttgart, Hailstone, Half-Long Scarlet, Icicle, Long White Vienna, Rapid Red, Scarlet Turnip White Tip, White Olive-Shaped, and Wood's Early Frame. All early sorts did well, the Icicle being the best. Chinese Rose Winter and Giant White Stuttgart proved to be of very little value.

Peas.—Peas as usual grew remarkably well, and yielded a heavy crop. Some of the taller growing varieties attained a height of 7 or 8 feet. Many pods of the Alderman, Duke of Albany, and Quite Content were 5 inches long, and 9 peas in a pod were common, while 10 and 11 were occasionally found. The extreme length of pod for the Giant "Sugar Sword" was 6 inches. The three varieties first mentioned, together with Gradus, Thomas Laxton, and Carter's Daisy, are of extra good quality. For the private garden good varieties would be Alaska, followed by Gradus or Thomas Laxton, with Alderman or Duke of Albany for late use. All the peas were planted May 3, and the following list gives the date when the first pods were ready to pick: Alaska, July 24; Alderman, August 10; British Wonder, August 8; Burpee's Best Extra Early, July 24; Carter's Daisy, August 18; Duke of Albany, August 10; Dwarf Champion, August 18; Extra Early Premium Gem, August 1; Giant Sugar Sword, July 26; Gradus, August 1; Improved Stratagem, August 10; Little Marvel, August 8; Nott's Excelsior, August 2; Quite Content, August 10; Telephone, August 16; and Thomas Laxton, August 1. The Telephone was not true to name.

Beans.—The English broad bean produced a large crop, while the common garden bean, represented by the variety Stringless Green Pod, produced a few pods, about one-half of which were affected by anthracnose.

Beets.—Garden beets grew only moderately well. Edmond's Blood Turnip proved to be the best of the three varieties planted, the largest roots reaching a diameter of 3 inches. Crosby's Egyptian reached nearly the same size, while Arlington Favorite was distinctly inferior. Swiss chard, Lucullus, made a fairly good growth.

Carrots.—All the varieties of carrots grew well and developed fine, smooth roots of the proper size for table use. Danvers Half Long and James's Intermediate yielded at the rate of about 20,000

pounds per acre. The smaller varieties, as Chantenay, Early Scarlet Horn, and Early Very Short Scarlet yielded somewhat less, while Improved Long Orange and Saint Valery gave heavier crops.

Parsnips.—Three varieties of parsnips were grown. Offenham Market proved to be the best, some roots reaching a diameter of 2¼ inches. The largest size reached by the Hollow Crown variety was 1½ inches. Early Short Round French is a very short sort that attained a diameter of 3 inches.

Onions.—The White Portugal or Philadelphia Silverskin again proved to be the best. The largest bulbs were 2¼ inches in diameter. Red Wethersfield attained a diameter of 2 inches. Yellow Danvers was not worth pulling.

Asparagus.—Asparagus does not seem to thrive well. Plants two years from seed are scarcely as large as they grow in one season in a more favorable climate.

Rhubarb.—Rhubarb thrives nowhere better than in Alaska. Spring-set plants were by late summer producing stalks upward of 2 feet in length, and from 1¼ to 1½ inches in diameter.

Lettuce.—Lettuce finds a congenial climate at Sitka, and trials were made of 14 varieties, as follows: Big Boston, Brittle Ice, Denver Market, Grand Rapids, Hanson, Long Lost, Maximum, May King, Morse, Naumberger or Tenderheart, Philadelphia Early White Cabbage, Prize Head, Salamander, Tomhannock. The Grand Rapids, Morse, Prize Head, and Tomhannock are nonheading varieties, the latter two being tinged with brown. Brittle Ice, Denver Market, and Hanson are crisp-headed varieties, while the others belong to the cabbage or butter-head class. The Salamander proved to be the best of the butter-head varieties, there being not a great deal of choice between the varieties of the other classes.

Celery.—Late varieties of celery having proved unsatisfactory in the past, only two of the earlier sorts were grown. These were the White Plume and Golden Self-Blanching. Both varieties did splendidly. (Pl. II, fig. 2.) Celeriac produced usable roots, but they were rather small and fibrous.

Parsley.—Parsley, as usual, grew well. Three varieties of the curled type were grown, and all were quite similar. The Hamburg or Turnip-Rooted produced roots from small to medium in size, with many side roots.

Spinach.—Victoria and Prickly or Winter spinach both ran to seed prematurely, but the New Zealand variety (*Tetragonia expansa*) produced good greens all summer.

Corn salad.—This valuable winter and early spring salad plant was planted at several different times. The sowing of July 23 attained the proper size for winter and spring use.

Cucumbers and tomatoes.—These were grown in the greenhouse during the summer. A cucumber variety of the white-spine group was fairly successful. The following varieties of tomatoes fruited well: John Bear, New Extremely Early Prolific, IXL, Prosperity, Red Currant, Sparks Earliana, and Yellow Cherry. A sort from northern Europe did not prove adapted to house culture.

Herbs.—Balm and lavender were put in flats and wintered in the old greenhouse. They came through in good condition. Hoarhound failed to survive the winter. Sage is quite satisfactory, and the mints do very well, indeed. Caraway and curled chervil matured quite well. Sweet fennel and Florence fennel both sent up seed stalks rather prematurely. Rosemary and winter savory grew only moderately well. Thyme, as usual, was very satisfactory. Wormwood made a very large, leafy growth.

ORNAMENTALS.

Trees.—A few trees each of English beech, Bechtel's flowering crab, flowering dogwood, English elm, Scotch elm, Norway maple, sycamore maple, and Bolle's silver poplar were obtained in the spring, but it is too early to make report on the value of any of them. The mountain ash grows finely and is valuable.

Shrubs.—In addition to the list reported last year the following have proved valuable: Siberian dogwood, golden-leaved elder, *Hydrangea paniculata grandiflora*, Spiræa Anthony Waterer, and *Ribes sanguineum*. The lilac and Siberian pea shrub made a better showing the past season than the previous one. Nineteen varieties of shrubs and vines were first set out during the spring, and it is hoped that a number of these will prove valuable.

Roses.—Of the roses tried at the station the Md. Georges Bruant, an everblooming white Rugosa hybrid, has proved exceedingly valuable. Agnes Emily Carmen has not done so well. An unknown red Rugosa hybrid is also very valuable. The buds on the Persian Yellow blasted before opening. Other roses are on trial but have not yet had a chance to prove how they will behave.

Perennials.—About 75 species and varieties of hardy perennials are now growing on the grounds at the station. Quite a number of these were started from seed the past year, hence their adaptability is not yet known. The following have proved from fairly to very satisfactory: *Achillea millefolium reseum*, the Pearl sneezeweed (*Achillea ptarmica*), columbines (Aquilegias), *Arabis albida*, Carpathian harebell (*Campanula carpatica*), Canterbury bells (*Campanula medium*), peach bells (*Campanula persicifolia*), crocus, cowslip (*Primula veris*), daffodil (*Narcissus* sp.), English daisy (*Bellis perennis*), Shasta daisy (*Chrysanthemum* sp.), foxglove (*Digitalis*

purpurea), forget-me-not (*Mysotis* spp.), *Geranium sanguineum*, *G. sanguineum album*, day lilies (*Hemerocallis* spp.), Siberian iris (*Iris sibirica*), *Lychnis chalcedonica*, Iceland poppy (*Papaver nudicaule*), Oriental poppy (*Papaver orientale*), perennial phlox, English primrose (*Primula vulgaris*), *Spiræa venusta*, and sweet william (*Dianthus barbatus*).

Peonies produce a few good flowers, but the plants do not increase in size as they should. Among the perennials treated as annuals, the pansy stands the winter here unprotected.

Annuals.—About 60 varieties of annuals were grown, and the following proved highly satisfactory: Snapdragons (Antirrhinum), asters, *Arctotis grandis*, *Bartonia aurea*, calendulas, candytuft (Iberis), cornflower (*Centaurea cyanus*), chrysanthemums (mixed), *Clarkia elegans*, coreopsis (mixed), Extra Early Large-Flowering cosmos, Chinese pinks (Dianthus), African Golden Orange daisy (*Dimorphotheca aurantiaca*), *D. aurantiaca hybrida*, California poppy (Eschscholtzia), feverfew (*Matricaria eximia* fl. pl.), Gaillardia, African marigold, French marigold, mignonette, monkey flower (*Mimulus tigrinus grandiflorus*), nasturtiums (tall and dwarf varieties), pansy, petunia (single mixed), *Phlox drummondii grandiflora*, *P. drummondii* (starred and fringed), Burbank poppy, Shirley poppy, poppy (double peony-flowered), *Rudbeckia speciosa bicolor*, stocks, and sweet peas (tall and dwarf).

Marguerite carnations made a fine growth, but were just beginning to bloom when cold weather came. Those lifted and taken into the house have done finely. Centaureas, other than *C. cyanus*, and the morning-glory were failures, while *Gypsophila elegans*, marvel-of-Peru or four-o'clock, verbenas, and zinnias did moderately well.

GREENHOUSE.

The new greenhouse was practically completed and first occupied on March 17, in time to start plants for the season. During the summer a few cucumbers and tomatoes were grown, the tomatoes being especially successful. While the house was erected primarily for plant-breeding purposes, a limited number of greenhouse crops, especially florist's stocks, are being tried. It is too early yet to report results, but there are indications of as successful crops as conditions will permit. Lack of light is the limiting factor for plant growth during the winter months, as the day reaches a minimum length of about six and one-half hours in December, with the sky usually overcast, while the maximum elevation of the sun at the winter solstice is only $9\frac{1}{2}°$. The cinerarias and primulas seem best able to thrive and bloom under these conditions. Nearly all stock tried is looking well, but the growth is slow, although calceolarias, primulas, ferns,

cyclamen, geraniums, chrysanthemums, carnations, violets, snapdragons, begonias, and several other plants are making steady progress. The rose seems least able to stand the adverse conditions. Lettuce and parsley do fairly well.

PLANT DISEASES.

Work on plant diseases was continued the past year, and some control measures tried. Conditions were quite favorable for the spread of fungi, as the summer was drier than usual, and there were heavy dews almost every night, with warmer temperatures than the average.

Clubroot.—Clubroot of cabbage and allied plants was unusually severe at the station the past season. The plants probably became infected in the seed flats, as numerous cases of infection were observed when the plants were removed from the flats to be set in the field. About 90 per cent of the cabbage, cauliflower, and broccoli was ruined by the disease, as was about 75 per cent of the kohl-rabi and 40 per cent of the Brussels sprouts and kale. Turnips and other root crops were only slightly damaged. This disease is due to a slime mold (*Plasmodiophora brassicæ*). Where infection is not too severe the plant often matures, although it is never so large as a healthy plant. Liming the soil is generally considered beneficial, and, above all, plants should never be set in an infected field.

Black rot.—This bacterial disease of cabbage has been common the last two years, but has not caused a great amount of damage. It is found on other members of the cabbage group and other Cruciferæ as well. The past season it was noted as affecting Brussels sprouts more seriously than cabbage. The organism is known as *Pseudomonas campestris.*

Botrytis.—The gray mold belonging to the genus Botrytis was again the most abundant of all fungi at the station. It was noted on more than 30 different hosts. It begins infection saprophytically by attacking the petals, dead or dying leaves, etc., in which a vigorous mycelium is developed. From these as centers, the mycelium spreads rapidly into any tissue with which it may come in contact, killing and rotting it. Sanitary measures are to some extent successful against this fungus. It seems to have been the cause of the blighting of currant blossoms, since conidia of Botrytis developed on the blighted flower clusters. The garden red currant (*Ribes rubrum*) suffered to a limited extent, and the black currant (*R. nigrum*) suffered to a much greater degree. The greatest damage, however, was done to *R. floridum*, *R. sanguineum*, *R. aureum*, and the native red currant, as on these scarcely a fruit set. It is not probable that the failure of these species to set fruit was due entirely to the Botrytis.

Potato diseases.—Only two potato diseases were at all common during the season. These are the scab (*Oospora scabies*) and a dry rot caused by a Fusarium (probably *F. oxysporum*). The scab is quite common, especially on some varieties, but the greater damage is caused by the Fusarium. The latter caused a loss in storage from fall to spring of 10 to 15 per cent. Other organisms may be associated with the tuber rot. The formaldehyde treatment has been used for the scab. This consists in immersing the potatoes one and one-half to two hours in a solution of 1 pint of formalin in 30 gallons of water.

Apple scab.—The apple scab (*Venturia inæqualis*) was not nearly so abundant in 1915 as it was the previous season. This may have been due to some extent to the drier summer, but chiefly to the two sprayings with Bordeaux mixture, one given as the buds were beginning to unfold, the other shortly after the fruit began setting. A small amount of spray injury was observed.

Mildews.—The gooseberry mildew (*Sphærotheca mors-uvæ*) was quite serious on some varieties of the English gooseberry, while others, notably the Whitesmith, seemed quite resistant. So far it has not been observed on the American gooseberry and its hybrids. *Ribes lacustre*, a native species which is very susceptible, was this year given two sprayings with Bordeaux mixture, one when the buds were unfolding, and the second after the fruit had set. The result was quite satisfactory.

The hop mildew (*Sphærotheca humuli*) was found on the garden red currant (*Ribes rubrum*) and on *R. bracteosum* and the salmonberry (*Rubus spectabilis*). On the last two hosts it did some damage. It also occurs on a few noneconomic hosts, and what is probably the conidial stage is at this time attacking the strawberry seedlings in the greenhouse.

The rose mildew (*Sphærotheca pannosa*) in its conidial form has proven a pest to roses grown indoors. The remedy usually employed is the evaporation, not the burning, of sulphur.

Erysiphe graminis on grasses and *Microsphæra alni* on alder are not common enough to be of economic importance.

Rusts.—One of the commonest of rusts during the past two years has been *Puccinia grossulariæ*, commonly called the gooseberry rust, although the æcidial stage is found on many species Ribes, while the alternate stages are found on species of sedge (Carex). Of the 14 species of Ribes growing on the station grounds, the following 7 have proven susceptible: *R. alpinum*, *R. bracteosum*, *R. lacustre*, *R. laxiflorum*, *R. rubrum*, *R. oxyacanthoides*, and *R. sanguineum.*

In 1914 *R. lacustre* was so badly affected with this rust and with mildew that it matured scarcely a sound fruit. This past season it

was sprayed, as already mentioned under mildews, with the result that the two pests did little damage.

Phragmidium occidentale has done some damage to the thimbleberry (*Rubus parviflorus*), and another species of Phragmidium was abundant on some species of roses.

Gymnosporangium sorbi affects the native crab apple and mountain ash. A number of other highly interesting species of rusts were collected, but they are of minor economic importance.

Witches' brooms.—The witches' brooms on the hemlock (*Tsuga heterophylla*) are caused by a member of the mistletoe family (*Razoumofskya douglasii tsugensis*). This is very abundant and of economic importance, as the hemlock is the second most important timber tree in southeastern Alaska.

Witches' broom of cherry (*Exoascus cerasi*) occurs on the sweet cherry (*Prunus avium*). It has not yet been observed on the sour cherry (*Prunus cerasus*).

Pea and bean diseases.—Last year *Ascochyta pisi* was reported as occurring on the pea. The past season it was again abundant, and the perfect stage, known as *Mycosphærella pinodes*, was also quite common. It does little damage early in the season, but becomes more or less destructive later.

A row of the common garden bean was badly affected by anthracnose (*Colletotrichum lindemuthianum*). The infection probably came from the seed. The bean does not do well and is grown scarcely at all in the coast region of Alaska.

Leaf spots.—There are two leaf spots affecting the strawberry. The common leaf spot of the States (*Mycosphærella fragariæ*) is found on *Fragaria chiloensis* and its hybrids, and, though common, seems to cause little damage. The other leaf spot is somewhat more destructive and seems to be confined to the native strawberry of the interior of Alaska (*Fragaria platypetala*) and some of its hybrids. The fungus has not been identified.

The leaf spot of gooseberry (*Septoria ribis*) was very abundant and caused early defoliation of some varieties.

Numerous other leaf spots occur, but the species either have not been identified or else are of little economic importance.

INSECT PESTS.

The worst insect enemy of horticulture at the station is the cabbage maggot. This is the larva of a fly (*Pegomyia brassicæ*) which resembles a house fly, but is distinctly smaller, with narrower body and proportionately larger wings. The female lays about 50 eggs, distributing them one or two to a plant, the eggs being deposited at the base of the stem. Where no preventive measures are taken, the whole root is sometimes destroyed. As a means of control, tarred

felt strips were placed around each plant of cabbage, cauliflower, broccoli, Brussels sprouts, kale, kohl-rabi, and pe-tsai, or Chinese cabbage, as they were set out in the field. These pieces of tarred felt were the simplest possible. The tarred felt was cut into strips about 3 inches wide and these strips again into squares. By means of a common tenpenny nail a hole was made in the center of each piece, with a slit from this to one side. This was slipped around the plant when it was set out, proving very effective. In several plants of pe-tsai, which is leafy to the base, a few maggots were noted above the tarred felt but none below. This method is practical for members of the cabbage group, but can not be practiced for such plants as turnips and rutabagas, which are grown in the field directly from seed. On these crops much damage was done, and, as noted elsewhere, some varieties suffered more than others. Some varieties of turnip and most of the rutabagas were ruined for market purposes.

An insect having damaged the apples to some extent, specimens were sent to the Bureau of Entomology, U. S. Department of Agriculture, and Dr. A. L. Quaintance reports having found several dead larvæ and one living larva of a moth whose identity he has not positively established. It is suspected to be *Argyresthia conjugella*, a European insect especially abundant in Norway and Sweden, and known for some years to occur in British Columbia. Fifteen to twenty per cent of the apples grown at the station this year seemed more or less affected. The insect can probably be controlled by the same means as the codling moth. The latter has not yet been observed.

A green aphis has been troublesome in the greenhouse, but occasional fumigation with a nicotine paper has served to keep it in check. The climate is too damp for aphids to thrive in the open.

REPORT OF WORK AT FAIRBANKS STATION.

By J. W. Neal, *Assistant in Charge.*

The work at the Fairbanks Station for the season just closed consisted mainly of routine farm operations. The season opened unusually early and seeding was finished two or three weeks earlier than ordinarily, which means much toward the possible maturing of crops.

Some 80 acres was in crops, including all varieties of seeds at hand, and it may be noted by a study of this report that all varieties of grain planted have fully matured, with the exception of some seed that fell on ground too dry to start growth in season; that upward of 1,200 bushels of grain and 260 pounds of turnip seed was thrashed; that 250 bushels of select turnips from a crop of about 400 bushels

is in the station root cellar for the next year's seed crop; that 600 bushels of potatoes was dug from 3½ acres of unfertilized ground; and that vegetation generally was no less than usual.

A small tract of unfinished clearing was completed and put in crop. About 1½ miles of new fence was built, and 20 acres summer plowing and 15 acres fall plowing was done.

The station received 60 rolls of rabbit wire, iron roofing for the cottage and the stock barn, one pole-saw outfit, one pump jack, and one power root cutter. The detailed report of the station follows:

CLIMATIC CONDITIONS.

As repeatedly stated in former reports, the weather of interior Alaska plays an important rôle in the growth and maturing of farm crops. The maximum and minimum monthly temperatures and the snowfall at the Fairbanks Station during six winter months, beginning with November, 1914, were recorded as follows:

Temperature and snowfall at Fairbanks Station during winter months, 1914–15.

Months.	Temperature.		Snowfall.	Months.	Temperature.		Snowfall.
	Maximum.	Minimum.			Maximum.	Minimum.	
	°F.	°F.	*Inches.*		°F.	°F.	*Inches.*
November	34	−14	5.50	February	36	−47	13.25
December	32	−17	20.00	March	56	−33	2.00
January	21	−32	4.50	April	61	3	2.50

The record shows a few days slightly colder than any during the winter previous, with exactly the same total snowfall (47.75 inches), not including an unprecedented snowstorm in August, 1913. The highest temperature record for the growing season of 1915 was 95° F., on June 26, while the highest temperature record of 1914 was 89° F., on June 16.

The rainfall for the growing season of 1915—that is, from May 1 to September 30—totals 9.95 inches, the precipitation during the corresponding period of 1914 being 10.15 inches.

The ground was unusually dry when frozen in the fall of 1914. This, under normal spring conditions, is most favorable for early seeding, and such conditions prevailed in the spring of the season just closed, but the summer rains held off too long for best results. The snow left the station yard this year on April 15, or 25 days earlier than in 1914. The soil was very nearly in condition for cultivation by April 27, when 2 inches of snow fell. This snow left the fields in 24 hours, but night freezing continued for some time, retarding soil drying considerably. Cultivation started on May 3, or 15 days earlier than in 1914. The first seeding was done on May 4, or 18 days earlier than in the last year.

As no rain fell during the month of May and only light showers during the entire month of June, the soil on the steep south slopes became exceedingly dry. The flatter lands and the slopes which receive more obliquely the rays of the sun do not dry out so rapidly. The underfrost is later in leaving these soils (flat lands), and they are, therefore, more valuable agriculturally under drought conditions. Such conditions hastened crops toward maturity this year, and on the whole it may be considered the best all-round season during the history of agriculture in the interior of Alaska. However, the latter part of the season proved most unfavorable for thrashing grain and saving other crops, owing to frequent rains with very short intervals of drying weather. Still, the station thrashed nearly 1,200 bushels of grain of all varieties from the shock before any snow fell. Eighteen tons of potatoes was dug without damage from frost, and 260 pounds of turnip seed was thrashed with slight loss from seed sprouting in the pod.

The latest date at which the temperature fell as low as 32° F. in the early part of the season at this station was on May 20, while the earliest date the same temperature was reached in the summer was on September 7, making a frost-free period of 109 days.

GRAIN CROPS.

The present season proved more favorable than usual for grain crops, so far as maturing seed is concerned. The weather in the first of the summer was exceedingly dry, and this induced early heading at the expense of the straw, which in most varieties was shorter than usual, with correspondingly smaller heads. As may be noted below, some of the barleys, oats, and spring wheats were ripe by the end of July, two to four weeks earlier than in former years. The latter part of the season proved very unfavorable for harvesting. The binder was out of the shed 29 days to harvest 50 acres. Thrashing covered a period of one month, but this was partly due to the lack of an engine to drive the station separator. The grain was in fit condition for thrashing several times, but before an available engine could be secured rain would wet the straw and delay the work from 5 to 14 days.

Seeding began on May 4 and continued without interruption until May 18, when the grain crops were all in the ground. With the exception of one sack of black oats all the seed grain was dipped in a formaldehyde solution to prevent smutting. Where the seed was dipped few smutted heads were produced, but where the undipped seed fell the crop smutted so badly that it was considered unfit even for hay. There was estimated to be 10 to 15 per cent smut over the whole patch.

FIG. 1.—RUSSIAN SPRING WHEAT H. G., FAIRBANKS STATION.

FIG. 2.—ROMANOV SPRING WHEAT, FAIRBANKS STATION.

FIG. 1.—OAT AND BARLEY FIELDS, FAIRBANKS STATION.

FIG. 2.—SIXTY-DAY OATS, FAIRBANKS STATION.

Russian spring wheat No. 36, a new variety, was seeded May 11 in drills opened and covered by hand, there being at hand only an ounce of seed. The first heads appeared June 22, when the straw was 15 to 18 inches in height. The earliest heads ripened by July 26 and were harvested on August 1. The heads were of fair size and well filled on 24 to 30 inch straw. At seeding time the soil was very dry, and much of the seed did not start until June 20, when the rains were sufficient to wet the soil. Notwithstanding such conditions, practically every head had ripened before frost.

Russian spring wheat, designated as H. G. from Tulun experiment field, Irkutsk Province, Siberia, was seeded May 10 and 11 with a hand drill. The first heads showed on June 22 at 18 to 20 inches high. This plat, being on a south slope, became so dry that only a small percentage of the seed started at first, making a very irregular stand. The late germinations were coming up June 20. With lack of proper moisture and with excessively hot weather the growth was much shortened. However, the crop headed quickly and sufficient rain fell in time to bring the heads to normal size. Practically the whole crop ripened and was harvested before any frost. The earliest heads were ripe by July 28 and were cut August 1 for special seeding, while the main crop was cut later with the binder. A few ounces of this variety was received from Siberia last year, from which 9 pounds of seed was ripened. This was all sown very thinly with a view to increasing the seed as much as possible this year, but the irregular stand gave a disappointing yield. Most of the seed will germinate and would doubtless mill by blending with other grades as is done in nearly all flour mills. From the 9 pounds of seed sown 614 pounds of grain was thrashed, but of this a small percentage will screen out as inferior for seed. A small plat that came up evenly was thrashed separately (see Pl. III, fig. 1), yielding 42 bushels per acre. The berry of this grain is small, but judging from the two years' trial it seems better suited to this country than any other variety tried at the station.

Romanow spring wheat, from the station crop of 1913, was seeded May 4 on a steep south slope with a horse drill. The soil was in a fine state of tilth, and the drill was set as deep as possible. The seed was in the ground so early that it was all up before the soil could dry to any depth. The first heads were showing by June 25, at 18 inches high. Many heads were ripe by August 1, and the whole crop was ready to harvest by August 10 or 12. It stooled well and stood 40 to 44 inches high, bearing large well-filled heads. The general stand was thin, but a small, fairly even plat was selected and thrashed separately, giving an estimated yield of 43 bushels per acre (Pl. III, fig. 2). Owing to wet weather the main crop could not be harvested for some time, and when finally harvested it shat-

tered badly. A plat of this variety was seeded very late in the fall of 1914, as the ground was freezing, it having been observed that volunteer wheat ripens several days earlier than the grain of spring seedings. It is apparent that seed sown late in the fall for spring germination will become soaked with the spring snow water before this can run off the ground, and that much of the seed will rot before the soil warms up sufficiently to induce germination. At least it proved so in this test, and the stand was too thin to carry the experiment through. This variety was so volunteered in the barley crop succeeding it that it seemed impossible to find a single sheaf of the barley from several acres of a subsequent seeding on other land which did not contain from one to a half dozen heads of the wheat thoroughly ripe and well filled. The wheat stubble was turned under in the fall, then stirred deeply in the spring. This treatment brought some of the shattered wheat berries to the surface, and these came up with the barley seeding that followed the wheat crop. On a portion of this ground which was left unseeded wheat kept coming up until late June, when the plat was replowed and seeded to alfalfa.

Marquis spring wheat was seeded on May 18 with a hand drill. The soil was so dry that only a small percentage of the seed germinated until late June after a heavy rain. The early germinations began heading by June 27, when 18 inches high, and ripened about August 20. The straw was coarse, measuring 4 feet in height and having long and well-filled heads. Owing to the irregular stand, no estimate of the yield can be given, but this variety is without doubt a heavy yielder, and, if it proves hardy, it is to be preferred to the other varieties above named, as it is the only beardless variety listed. This wheat was received last year too late for seeding. It was overlooked in the following spring until May 18, when it was found and immediately seeded on the best ground then available. This did not give it so fair a trial as the varieties seeded several days earlier. Three bushels of this grain was thrashed from the early germinations, having been culled from the plat with a hand sickle. The grain is of good milling quality, and is seemingly a hard or glutenous wheat.

Buckwheat, seeded broadcast and disked in on May 15, made a rapid growth, and the stalks branched out well. It was in continuous blossom from June 24 until harvested late in the fall. The seed began to ripen by July 26. While the yield was not estimated, it was considered good by all observers. A small plat thrashed out 5 bushels of good, full grain.

Hull-less barley No. 19851, from the station 1914 crop, was seeded May 6 with a horse drill in a field plat on a south exposure. It showed the first heads on June 25 at 16 to 18 inches tall. Many

heads were ripe by July 20, and the whole crop was ready to cut by July 28. The soil kept very dry throughout the growing period, which hastened heading and ripening. The straw was unusually short and the heads were considerably below normal size; still, a plat 85 by 460 feet thrashed out 1,650 pounds, or about 1,825 pounds per acre. A larger tract on a north slope was seeded on May 11 by hand sowing, and covered with a disk harrow. The first heads were showing June 25 at 20 to 28 inches tall. This field ripened about 10 days later than that on the south slope, yielding about 15 sacks. The straw was somewhat taller, but owing to the lighter soil the yield in grain was not quite so heavy, although the soil showed plenty of moisture throughout the season. This barley has never failed to ripen the full crop at this station when seeded reasonably early. (Pl. IV, fig. 1.)

Beardless barley No. 19852, from station-grown seed, was seeded May 6 on a south slope. It showed the first heads on June 20 at 18 to 21 inches tall. These heads were ripe July 20, and the whole crop was ready to cut by July 28. A seeding on a north slope gave a taller growth but a considerably lighter yield, for reasons similar to those given for the hull-less barley. The two tracts yielded 140 bushels. The yield of the south-slope plat was estimated at 30 bushels per acre, while that of the north-slope plat did not exceed 20 bushels per acre.

Hybrid barley No. 4 A1, Chittyna × Oderbrucker, seeded on May 12, from station-grown seed, began heading June 23, at 24 to 30 inches in height. This seed was hand-drilled on a south slope which became very dry, and germination was so irregular that most of the crop was cut for hay after a few bundles had been picked out from the early germinations ripening from August 1 to August 8. The straw was tall and coarse, with very large heads. More than 10 per cent of the heads bore long, heavy beards, notwithstanding the fact that only beardless heads were selected from the previous crop for seed this year. This variety makes a vigorous growth and is a heavy yielder both in straw and grain, but its persistent tendency to throw out innumerable bearded heads is objectionable, since clean seed can only be obtained by hand picking. It was expected that this hybrid would become constant as a beardless variety after two or three generations.

Canadian oats, seeded on May 15 from station-grown seed in a small plat by hand drill, showed the first heads on June 27 at 18 inches in height. The oats ripened about August 10, standing 40 inches tall and bearing a heavy yield of grain.

Sixty-day oats was seeded on a south slope May 8, with a horse drill. The seed was from the station crop of last year. The first heads appeared June 22, at 12 to 15 inches in height. The crop was

ripe by July 30. The stand on this plat was very regular, but the extremely early, dry summer caused a very short growth of straw with small heads. This is also an early heading and early maturing variety. A larger tract, on a north slope, was seeded broadcast and disked in on May 13. The growth and yield was not materially different from that on the south slope. This plat was heading June 25 and ripened about August 1, or nearly at the same time as the south-slope plat, which is an unusual occurrence. The two tracts yielded 175 bushels of grain, or about 40 bushels per acre. (Pl. IV, fig. 2.)

Finnish Black oats from station-grown seeds of the 1914 crop was seeded May 10 on a south slope. The stand was very regular, but the growth was poor, due to the usual conditions on this slope. This is a very tall variety and a heavy yielder. It started heading June 26, at 18 inches in height. The crop was ripe by June 30, being much hastened by the drought conditions. A plat 67 by 600 feet yielded 18 sacks, or about 60 bushels per acre, as compared with a yield in other years of 90 bushels per acre on similar soil. A rather flat field with southern exposure, containing 25 acres of new ground formerly covered very thinly with small scattering spruce and alder shrubs, was seeded to this variety May 15 to 18. The field made a very fair crop, as compared with the older south-slope fields that had been densely covered with birch timber, but the grain ripened considerably later (Pl. V. fig. 1). The rabbits destroyed the crop for several feet around the edge of this entire field, and in some instances their trails led far into the field, where large patches of the grain were destroyed. Still the crop thrashed out approximately 700 bushels of good grain. This field is at the back of the reservation, with brush or timber on all sides, and there is no travel in the vicinity. The station now has wire netting with which to inclose the field.

Gesselberg spring rye from station-grown seed of last year was seeded on May 15. It started heading June 22 but matured very slowly and irregularly. A small tract was cut early in September, which thrashed out 100 pounds of fair seed.

WINTER GRAINS.

Twelve varieties of winter wheat and four of winter rye were seeded on August 4 and 5, 1914. Each plat made a very fair fall growth. Of the wheats Pullman Hybrid No. 128, Wisconsin Pedigree No. 2, Pullman Red Russian, Wisconsin Pedigree No. 22, Bluestem, Pullman Hybrid No. 143, Pullman Winter Fife, and Pullman Fortyfold were winter killed. Kharkov, Wisconsin Pedigree No. 2, Pullman Turkey Red, and Beloglina wintered a fair stand, but

FIG. 1.—FINNISH BLACK OATS, FAIRBANKS STATION.

FIG. 2.—CLOVER, PANSIES, AND SWEET PEAS, FAIRBANKS STATION.

FIG. 1.—TOMATOES GROWN OUT OF DOORS, FAIRBANKS STATION.

FIG. 2.—POTATO FIELD, FAIRBANKS STATION.

practically all of these varieties were killed by the spring freezing and thawing after the snow left the plats. This is the first occurrence of the kind in the history of the station.

All of the ryes wintered a fair stand but were much damaged by the spring freezing and thawing. Winter rye No. 19556 proved most hardy and ripened a small amount of rather inferior seed. The straw was 2 feet shorter than usual, owing to the drought, but unlike other grain crops, the ripening was very irregular and much later than usual. Fall rye gave practically the same results, with a slightly lighter yield in seed. Wisconsin Pedigree Nos. 2 and 3 were both so badly killed out by the freezing and thawing that the plats were broken up and reseeded to spring grains.

Five varieties of winter rye and 12 of winter wheat were seeded on July 14, 1915. Every plat was covered with a heavy growth and well matted over when the ground froze. The fall seedings made a decidedly better growth this year than any previous seeding at this season. A light snowfall covered the plats as the ground started to freeze.

ALFALFA.

The seedings of 1914 were all winterkilled, except a few scattering plants of the new Siberian varieties mentioned in the last report. These were taken up and reset in rows 18 inches wide and 1 foot apart in the row. The early summer proved so dry that these plants did little more than keep alive through May and June. After that date they made a fair growth, as is indicated in the following notes:

North Swedish alfalfa.—About 300 plants wintered and were transplanted in the spring. The plants produced very spreading or bushy tops of 18 to 20 inches' growth, blossomed freely, and set some seed, none of which ripened. The rows were extended with new seed, which made a more upright growth of 15 to 20 inches, blossomed freely, but set no seed.

Hansen's Cherno alfalfa.—Some 80 plants wintered and were transplanted in the spring in rows suitable for cultivation. The plants made 2 feet of spreading growth late in the season as the soil became moist enough to revive the tender plants. Some seed set but none ripened. These rows were extended with new seed, which made a more upright and compact growth of about 2 feet. Most of the plants blossomed, but no seed set.

Hansen's Cossack alfalfas.—Sixty plants which wintered over were transplanted in the spring for convenient cultivation. The growth was very slow until the July rains saturated the soil to the depth of the roots. The plants made a rather spreading growth of 18 to 24 inches. Some seed set but none matured. These rows were also ex-

tended with new seed, which made a close, upright growth of 18 inches. Most of the plants blossomed, but no seed pods formed.

Hansen's Semipalatinsk alfalfa.—About 300 very small plants wintered and were transplanted in rows for cultivation. These plants made quite a spreading growth, with stiff, brushy stems, late in the summer after the rains set in. This variety blossomed freely and set a considerable quantity of seed, but none actually ripened. These rows were extended with new seed and the tract much enlarged with additional rows suitable for cultivation. The new seeding made a better growth and blossomed quite freely. It set some seed, none of which ripened.

New seedings.—The soil was too dry for the usual shallow seeding. To aid in early germination, deep furrows were opened with a hand plow and the seed covered lightly in these furrows; then the soil was packed with the wheel of the plow. Even with this treatment only a very thin early stand was obtained, and the crop notes are confined to these early plants.

Grimm alfalfa No. 162, Pioneer Strain alfalfa, Disco alfalfa No. 28, and Grimm's Coin Holder alfalfa (Glenheim strain) were seeded on May 13 in the above manner. The four varieties all made a heavy top growth and started to blossom by July 11 to 13. The early plants of each variety were loaded with well-filled seed pods, but the fall weather proved unfavorable for ripening seed. There was little or no noticeable difference in growth or advancement in these four varieties.

Orenburg common alfalfa of Montana selection and Glenheim White Blossom were received late and seeded June 12. Each variety made a very fair growth and showed a few blossoms, but no seed pods set. The latter did not produce a white blossom.

Hardy Grimm alfalfa, a new lot of the Orenburg, and Semipalatinsk seed were received and seeded on June 22. All of these made a very fair growth, but no blossoms were observed.

CLOVER.

The red clover seeded last year was winterkilled, and another plat was seeded late in May of this year. After rainy weather set in and the atmosphere became cooler, this clover grew very rapidly and blossomed freely. (Pl. V, fig. 2). A considerable quantity of seed practically matured, but there was not enough drying weather to attempt to cure the crop for seed.

THE GARDEN.

Gardening is one of the chief industries in the interior of Alaska, as many people make their living from their vegetable crops. The station crop is confined in most part to a few hardy vegetables for

home use only. The early opening of the season forced the rhubarb far ahead of its growth in other years. Nice stalks were cut on May 19. The first cabbage was cut July 20, the first cauliflower a day later. Early Red Valentine and Stringless Green Pod beans were planted in deep furrows May 14, after the furrows had been wet with a sprinkling pot. These came up very quickly and made rapid growth. The vines blossomed freely and were full of pods. The first beans were picked July 23, and from that date both varieties bore heavily until the end of September. The Stringless Green Pod found our preference, and some plants bore mammoth pods. One row of salsify, or oyster plant, made a good lot of fair-sized roots. Lettuce, radishes, carrots, peas, parsley, turnips, celery, etc., did as well as usual. Twenty tomato plants were set in the open garden early in June. These plants bore from 6 to 10 pounds to the vine, and about 30 pounds ripened thoroughly on the vines (Pl. VI, fig. 1).

From the several varieties of hybrid strawberries received from the Sitka Station in 1913, eight varieties, No. 275, No. 1503, No. 868, No. 288, No. 906, No. 1350, No. 614, and No. 99, have survived the first winter in the open garden without cover other than the natural snowfall. Owing to the dry early summer and to the lack of irrigation other than with a watering pot, none of these set enough fruit for comparison, so the late runners were left undisturbed in order to increase the number of plants. After the July rains saturated the soil and cooled the atmosphere, all the vines made a rank and thrifty growth, covering the whole surface of the beds with young plants. The vines were left uncovered again this fall, since any litter would afford shelter for field mice. The beds were covered with snow as the ground started to freeze, which should afford ample protection for the plants.

A few rows of wild red raspberry were set in the garden this spring from a clump of bushes in the field. These vines produced a superior berry under cultivation, even in the first year. The berries were also free from worms, and the green aphis did not attack the canes, while the vines in the woods were badly infested with these pests. It is probable that any farmer or gardener who will set out an acre or two to these native berries and cultivate them properly will be well rewarded for his trouble. Clean berries from the woods usually sell at the town restaurants for 50 cents a pound, but the berries are often rejected as being wormy and inferior in quality. All the wild berries show decided improvement wherever the soil has been disturbed, as along old trails or roads and along the railroad grades.

FLOWERS.

The flowers of interior Alaska are perhaps one of the most attractive features to the tourist, for they may be seen early and late in

almost every yard and garden in the country. And in season many wild flowers appear in every nook and corner of forest and plain. Poppies, pansies, pinks, daisies, asters, petunias, marigolds, snapdragons, dahlies, candytuft, sweet alyssum, gypsophila, etc., were unusually attractive about the station yard, while the rustic cottage peeped out through the usual arbor of sweet peas, which measured more than 10 feet tall (Pl. V, fig. 2). In the background stood a clump of summer cypress (*Kochia scoparia*), with plants taller and broader, it is claimed, than any observers had ever seen before. In the midst of this miniature forest of cypress stood some stalks of Burbank's Rainbow corn in colors well defined and much admired. Another attraction in the station yard was a huge pansy bed of a thousand volunteer plants from seed that fell on the ground from a similar bed last year. In the flower garden, pansies, snapdragon, gypsophila, and candytuft ripened seed. Sweet-pea pods filled but did not mature their seed fully.

THE TURNIP CROP.

Pursuant to instructions, 150 bushels of select Petrowski turnips were kept through the winter and set out in the spring with a view to ripening seed. The soil became very dry, and, with no means for irrigation, the only thing to do was to set the turnips in deep furrows and wait for rain. Probably 95 per cent started growth, but about half of these died before any rain fell. The live plants made only fair stalks, and the wind broke many of these down. However, those that survived blossomed freely and set seed abundantly, which began to ripen late in July. The crop was gathered at several pickings, for ripening was very uneven. New stalks continued to set and blossom all summer, and numerous seed pods were still green at the end of the season. Wet weather induced a new late or continuous growth, and much ripe seed was damaged in the pod before it could be gathered. The seed sprouted even to the top of the stems, where the pods burst open enough to let the rain in. Two hundred and sixty pounds of seed was finally saved from the lot. Much seed fell out of the pods before it could be gathered, owing to the uneven ripenings. Practically the whole surface of the tract was covered with young turnips, many of which, where the seed fell thinly, grew large enough for table use. A new lot of the Petrowski seed was received from Finland and sown for further seed production. From this 250 bushels of select turnips are now in the cellar for the new seed crop.

THE POTATO CROP.

The station potato crop comprised 15 varieties, with a total yield of 18 tons from 2¼ acres of south slope and 1¼ acres of north slope

land (Pl. VI, fig. 2). The seed was dipped in corrosive sublimate solution (2 ounces to 16 gallons water) and soaked one hour and a half with a view to preventing both potato scab and the Rhizoctonia diseases that had been rather abundant in the last crop. The latter fungus affected the new crop only slightly, but the corky scab and potato rust were much worse this year than in any previous year in the history of the station. That the diseases are prevalent over the country is evidenced by similar reports coming in from every quarter. In Fairbanks garden plats were observed in which scarcely a single potato could be found that was not badly infected with the scab. These scabs are more like scales, and many of them will rub off easily, leaving a dim scar. Some tubers were found to be covered with a heavy rust and a tough, checked skin. These seemed to be more mature than the smooth thin-skinned tubers, as they were more mealy when cooked. The cooking quality is pronounced excellent from all over the country, regardless of the disease, but it is not advisable to plant seed from infected stock or clean seed on infected soil. The formaldehyde treatment did not seem to check this disease materially this year. Some soil treatment may be necessary to prevent the malady from developing when the organism is already present in the soil, or the introduction, if possible, of a scab-resistant variety may serve the same purpose. Few early settlers have sufficient available cleared land for much crop rotation or shifting of crops, and since the potato is the money crop they must raise potatoes.

The total estimated yield for the Fairbanks district has reached 900 tons. Two homesteaders with land adjoining the station have estimated their potato crops this year at 100 tons each, and it is believed that 300 tons was produced within 2 miles of the station limits. This estimated yield is probably double the consumption of the entire district, to say nothing of the large quantities imported from the States during the open season. The station crop was intended in most part for stock feed, and in fairness to the farmers who can not hope to sell their entire crop, only seed potatoes will be offered for sale from the station crop, and these will have to be sold at very reasonable prices. The current price for native potatoes at present is $50 to $60 per ton delivered in town, or on the creeks, at the mines.

All varieties in the station crop were planted on the south slope May 21 and 22. The seed pieces were cut to medium size and dropped by machines 16 inches apart in the row. Gold Coin was first to blossom, on July 10. Others followed within one to four days, Eidlewile blooming last on July 14. The field was white with blossoms for several weeks. Some rows of each variety were measured and

dug, after which the tubers were weighed. The following table will serve to compare the actual yield:

Comparison of yields in variety test of potatoes.

Variety.	Length of row.	Weight of tubers.	Variety.	Length of row.	Weight of tubers.
	Feet.	*Pounds.*		*Feet.*	*Pounds.*
Gold Coin	2,965	2,570	Eidlewile	267	170
Extra Early Ohio	1,000	455	Noroton Beauty (local origin)	80	50
Eureka	1,987	1,500	Vornehm	660	325
Ohio Junior	926	520	Beauty of Hebron (local origin)	336	250
Irish Cobler	1,943	1,425	Vigerna	571	400
Burpee's Early	3,060	2,014	Early Market	722	420
Michigan Early	381	215	Extra Early Pioneer	1,427	910
Alaska Beauty	398	200			

Some 20 new varieties of seed tubers were received in the fall from Sitka Station, and these will be planted with the next crop for comparison.

LIVE STOCK.

It is commonly considered among the farmers of interior Alaska that there is no money in raising stock of any kind under present conditions. While many of the farmers have raised hogs in a small way, several have gone out of the business.

The station herd numbers 20 shotes and 5 old hogs. It was intended that the increase from this herd of Duroc-Jersey Reds should be sold to the farmers for breeding purposes, but there seems to be no demand for these as breeders, and it does not seem profitable to raise hogs for meat. One farmer in the community has adopted a plan of selling all of the increase as soon as the pigs are weaned. The usual price is $10 to $15 a head. He claims that the amount of imported feed necessary to put hogs in fit condition for meat will cost more than the meat will bring. The sows can be kept in fair condition on the surplus garden and root crops with very little grain, and by selling the pigs before they have to be fed, it seems reasonable that there may be some gain so long as there is a demand for the pigs.

The station has no other live stock except one team of mares and one yearling colt. This colt was referred to in our last report. To say the least, she is now an animal of beauty. At 1 year old she weighed 875 pounds.

REPORT OF WORK AT RAMPART STATION.

By G. W. Gasser, *Assistant in Charge.*

CLIMATIC AND GENERAL CROP CONDITIONS.

A summary of the weather for the last 10 years, beginning with January, 1906, and ending January, 1915, is given in the following table:

Condensed climatology of Rampart.

Year.	Precipitation.		Temperature.					Yukon opened.	Yukon closed.	Number of days ice running.	Number of days between frost.
	Winter.[1]	Summer.	Maximum.	Minimum.	Mean winter.	Mean summer.	Yearly mean.				
	Inches.	*Inches.*	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*				
1906.....	2.81	5.40	84	−66	−1.12	52.62	21.27	May 13	Nov. 10	31	96
1907.....	5.26	10.27	85	−59	.46	51.28	21.65	May 9	Nov. 2	26	107
1908.....	4.70	5.35	89	−61	5.27	51.69	24.61	May 14	Oct. 29	24	99
1909.....	4.55	5.67	90	−56	−3.31	50.21	18.90	May 17	Nov. 5	34	90
1910.....	2.38	2.94	92	−64	− .22	54.27	22.48	May 18	Nov. 6	31	84
1911.....	5.94	3.16	91	−61	.24	54.52	22.82	May 13	Nov. 7	14	107
1912.....	3.47	7.45	94	−44	1.45	51.06	22.12	May 14	...do	19	110
1913.....	3.60	5.06	94	−55	2.27	54.85	24.18	May 19	Oct. 29	17	89
1914.....	1.48	4.55	92	−45	6.89	52.93	26.07	May 17	Nov. 12	26	85
1915.....	1.74	6.78	97	[2]−33	5.94	54.09	[2] 25.99	May 11	Oct. 30	19	107
10-year average..	3.59	5.66	90.8	−54.4	1.79	52.75	23.01	.....	.....	24.1	97.4

[1] Melted snow.

[2] Until November.

The two most vital factors presented in the table, temperature and precipitation, are more indicative of potential agriculture in the Yukon Valley than volumes of description. It will be observed that the year is divided into two periods—summer, comprising May, June, July, August, and September, and winter, embracing the other 7 months. Including melted snow, the 10-year precipitation average for the winter period is a little over 2 inches less than the 10-year average for the summer period. The average yearly precipitation is 9.25 inches.

While 10 years is much too short a period from which to draw climatological conclusions, yet it is interesting to note in a tentative way that if this part of the interior (middle Yukon region) were properly placed on a precipitation chart of the United States it would cover the area occupied, rather centrally, by the State of Nevada, a region having less than 10 inches of annual precipitation and given over to sagebrush, cacti, and dust (except where irrigated). In marked contrast, in the middle Yukon region, where the annual precipitation is also less than 10 inches, the hills and valleys are forested with spruce and birch, grass is abundant, and bush fruits abound. In the garden and field vegetables and grains yield fair crops without irrigation. These facts are indicative of the value to the Alaskan farmer of having the soil water stored up as ice for 7 months of the year, to become available during these few long summer days when nature makes haste, for what is to be done must be done quickly.

However, it must not be inferred that less than 10 inches of precipitation (including snow) will produce bountiful crops in Alaska on ground cropped continuously. The lack of timely rain during June and early July is a serious handicap. Yet when it is remem-

bered that out of the 9.25 inches annual precipitation 3.59 inches falls as snow and is largely lost in the spring run-off while the ground is still frozen, the showing which vegetation makes on 5.66 inches of rain is truly remarkable. In the forests, where the natural covering remains on the ground, it is not hard to understand how so much growth can result from so little water. There the ground thaws but a meager foot or two, and consequently little moisture is lost by evaporation and none by percolation. Under field conditions this is necessarily all changed. The bare ground thaws down 6 feet, and often more. For a time in the spring the moisture thus released becomes available to the growing plants, but as the season advances and the ground thaws deeper, the free water in the soil follows the receding frost. This is especially true of fields under cultivation for several years. If the moisture in the first foot of soil is not replenished by fall rains, it is evident that in the following spring the available supply is bound to be deficient.

It is estimated[1] that 9 inches of water completely utilized will produce 30 bushels of wheat or 42 bushels of barley per acre. Remembering that the 10-year average here is 9.25 inches and that only 5.66 inches of that falls during the summer months, it is apparent that the seasonal rainfall must be supplemented by water from the subsoil, and it would seem that the amount available from that source would be the limiting factor in crop production so far as moisture is concerned.

The winter of 1914–15 was unusually mild, being the mildest on record here, with a minimum temperature of —33° F. Practically no snow fell during October and not much during November. By spring there was a scant 16 inches in the woods and sheltered places. The fields, all knolls and slopes exposed to the winter winds, were either bare or nearly so. Hence the ground thawed earlier than usual. Thawing during the day and freezing at night injured certain plants. Since the precipitation the preceding September was 0.5 inch, the ground in the spring was dry enough to work as soon as the frost was out. This permitted early seeding, and the first fall frost coming August 30 gave a growing season of 107 days, which is 10 days longer than the 10-year average. The shortest period free from frost during the last 10 years is 84 days, the longest period 110 days. During June and July of that period no frosts occurred. This year the earliest wheat ripened in 87 days, the earliest barley in 79 days, and the earliest oats in 94 days from date of seeding to date of harvest, both dates inclusive.

The growing season of 1915 was normal as to temperature and above normal as regards precipitation and frost-free period. Un-

[1] Michigan Sta. Bul. 219 (1904).

FIG. 1.—CUTTING OATS FOR HAY, RAMPART STATION.

FIG. 2.—STORING HAY, RAMPART STATION.

FIG. 1.—PLANT OF GRIMM ALFALFA, RAMPART STATION.

FIG. 2.—VARIATION IN PODS OF GRIMM ALFALFA AS GROWN AT RAMPART STATION.

fortunately the rain came late in the season. This was hard on the crops generally. However, the 2.99 inches of rain during September was very acceptable, inasmuch as it put the ground in good condition for next spring.

GENERAL WORK.

The work of the season followed the lines laid down in previous years. Ten acres of lowland, on which moss and trash had been piled the previous season, was burned over and plowed. When first cleared and plowed this ground is very wet and in spots even boggy, but after being exposed to the sun and wind for a summer the ground thaws and drains out. Fifteen acres of this lowland is now under plow. Adjoining this is a tract of similar land of some 20 acres. When this is cleared the whole area will comprise about 45 acres fronting the river. This rectangle can then be laid out in permanent fields and used for crop rotation and liming experiments.

Some 17 acres were cropped for grain hay, but because of the dry weather only 3½ acres of lowland made a satisfactory crop. This field was thick with oats which stood shoulder high in places. The crop was cut with the binder August 17 when in the soft dough stage. The bundles, heavy and grass green, were set up in small shocks without caps. Later, after several days drying, the shocks were rebuilt and capped with one bundle. A few days later, in order to cure the inside of the bundles, most of them were turned inside out. This could be done rapidly, for in the drying-out process the bands became quite loose, permitting the shift to be made in about half a minute to the bundle without cutting the band. From the time these oats were cut and shocked until cured and stored, September 9, 1.17 inches of rain fell. If the heavy growth had been cut with the mower, raked, and cocked in the usual way, it would have been impossible to cure it in a satisfactory manner (Pl. VII, figs. 1 and 2).

Another field was seeded with oats for hay on May 8. A good stand resulted. This field comprised a high knoll, some gently rolling land, and about an equal amount of lowland. The knoll had been summer fallowed the year before. On the rest grain followed grain. With the exception of the knoll and a northeast slope adjoining, where the snow had lain rather late, the growth was very short, with practically none in places. The ground was so dry and loose that the mower raised a cloud of dust and left ruts 2 and 3 inches deep. This was on July 13. Ten days later there were some light showers. The stubble field took on new life and soon there was a second growth, better in most places than the first. This second growth headed and bloomed, and, although rather short, it was cut with the binder August 26. It cured well and made about four loads of splendid hay.

The 1-acre field seeded to brome grass in 1910 continues to give a perfect stand, but the crop of hay was very light this year, being scarcely half a ton per acre. From a draw above water runs diagonally across this field, but even there the growth was far from luxurient. In the draw above, also seeded to brome grass, the crop was much better. This is newer sod, but the most probable reason for the better crop is that there is some seepage from above where the draw heads into uncleared land. As soon as the snow is off next spring it is planned to give these meadows a top-dressing of stable manure, as far as the winter's accumulation from three horses will permit.

Heretofore it has been the practice to haul the manure out early in the spring, leaving it on the land in piles until ready for the plow. After plowing the land has been left idle until the following spring. Since the manure is quite coarse and the summer rains scanty, this method has not given entirely satisfactory results. The straw in the manure rots very slowly, and until it is thoroughly incorporated with the soil the ground is kept too loose for best results here. The use of a subsurface packer and a roller would be a great help in bringing this loose layer of top soil back into intimate contact with the subsoil.

LEGUMES.

The work with alfalfa has been established along definite lines. By the rigorous tests imposed by the climate the 20 strains and varieties of alfalfa have been reduced to 4 that are perfectly hardy. These are *Medicago falcata*, Omsk, Obb, and Gobi Desert, all yellow-flowered.

Grimm, Sand Lucern, Mongolian, and Cherno alfalfas, all purple-flowered, are only partly hardy. Seedings made three years ago of these varieties have gradually been winterkilled. In the spring of 1914 other plats were seeded, this time with station-grown seed. A very good stand resulted and the first season's growth was vigorous. In the spring of 1915 fully 50 per cent was dead. An early examination, made as soon as the ground was thawed about 2 inches, showed the roots and crowns to be in good condition. In fact, at that time very few dead crowns were found. Then came two weeks of thawing and freezing weather. After a few days of settled growing weather in May it was apparent that many of the plants that had withstood the winter were so weakened that the new shoots soon withered and the plants died. Even the healthy plants made a slow growth during May and June, lacking the vigor characteristic of Grimm and allied varieties. During July and August they made good growth and by the end of the season averaged 2 feet high, with many trailing branches 3 feet long (Pl. VIII, fig. 1).

In the half-acre plat of Grimm were found a number of plants showing considerable variation from standard. In general the variant had narrow leaves, flowers of varying shades of green, yellow, and purple, and combinations of these colors, and falcon-shaped pods, brown when ripe; whereas the true Grimm has broad leaves, purple flowers, and spiral pods that are black when ripe. (See Pl. VIII, fig. 2.) A number of these variants were staked and the seed gathered separately. It is possible that some of them may prove hardy. Evidently these variants are the result of cross-pollination by insects, probably bees, of which there are many. Late this summer an examination of the roots of the Grimm alfalfa growing in this half acre and a few survivors of the same variety in another plat seeded a couple of summers ago, showed that well-developed root nodules were fairly plentiful. This half-acre plat was inoculated in 1912 with alfalfa soil from the Agricultural Experiment Station, Brookings, S. Dak., and another smaller plat with a proprietary culture of nitrogen-fixing bacteria. Root nodules were also found in plats not inoculated, but not so well developed as in the inoculated plats.

Since only the yellow varieties of alfalfa have proved hardy, particular attention is being given to them, and especially to *Medicago falcata*. The first plat of this valuable variety was seeded June 2, 1911. A very little seed ripened in 1912. The following year about 15 per cent of the pods ripened. In 1914 practically no seed ripened. This year 50 per cent of the seed ripened, practically all of it ripening on some plants. The ripe seed shatters very freely, so, in order to save as much of it as possible, the ripe pods were hand picked, the plat being picked over on successive dates. Even then considerable seed fell to the ground. The plat had been seeded in drill rows and this spring it was a mat of plants. In order to increase as rapidly as possible the area of this valuable legume, a couple of thousand plants from the above plat were transplanted this spring, being set about 30 inches apart each way. (Pl. X, fig. 1). These plants made a splendid growth, many of them ripening considerable seed. Here too, variants were found, one having brownish, purple-tinted flowers, in this respect resembling the Grimm, as also in its upright growth and shape of pod. The differentiation of the other variants consisted chiefly in fineness or coarseness of stalk and leaves, form and size of flowers, shape and size of pods, and size and color of seed. (Pl. IX, fig. 2.) It was observed that the coarse-stalked plants almost invariably bore more seed than the fine-stalked ones. A number of these plants were staked and the seed collected and kept separate.

A small plat of Omsk alfalfa made a good showing, ripening considerable seed on most of the plants and practically all on a few. In general characteristics Omsk and an unnamed variety of

Medicago falcata are very similar (Pl. IX, fig. 1), being fairly erect in growth, yellow-flowered, and hardy. Gob. Desert and Obb alfalfa are equally hardy, but of procumbent growth, and, furthermore, they have never ripened seed. The blossoms are apparently sterile.

Trifolium lupinaster is conspicuous only because of its hardiness. No matter what the season may be, wet or dry, long or short, its seasonal performance is unaffected. It sends its upright stalks with their scanty foliage to a height of 16 inches, and begins to bloom the latter part of June. A month later the first heads are ripe, and by the end of the season practically all have ripened. This is the unvarying record of a plat seeded in 1911. The plat is favorably situated as to moisture. Another plat seeded on a warm slope in 1914 is doing no better. From the standpoint of hay production, *Trifolium lupinaster* is practically a failure.

After noting the plat of *Trifolium lupinaster*, it was encouraging to see the plat of bird vetch (*Vicia cracca*). This triangular plat of one-eighth acre was seeded May 26, 1914. It made a fair growth that season and came through the winter in perfect shape. This year the growth was strong, producing a tangled mass which, when cured, made 300 pounds of excellent hay (Pl. X, fig. 2). From this plat half a gunny sack of ripe seed pods was picked, practically all of the pods having ripened. *Vicia cracca* is purple flowered, the flowers being borne in one-sided racemes. The pods average seven-eighths inch in length and are brown when ripe, with black seed.

Growing among the purple-flowered vetch was found a yellow-flowered sort of vigorous growth. The leaves were more numerous than on the purple-flowered variety, although not quite so large. The flowers, unlike the purple sort, were borne in terminal clusters or whorls. The pods were 1¼ inches long and black when ripe, with brown seed. The seed was gathered separately.

HYBRIDIZATION.

Considerably more hybridizing was done this year than last. This year, however, the different species came into bloom in more than ordinarily rapid succession, due to the hot weather, so that not nearly so much cross-pollinating could be done as had been planned.

This work began June 25, when a number of heads of winter rye were worked over. In all, 18 heads were cross-fertilized in order to produce an earlier-maturing strain and one having more uniformly well-filled heads.

Following the winter rye a few heads of barley and spring wheat were cross-fertilized. The work with the grains had to be slighted because is was thought advisable to devote as much time as possible to the alfalfa. Accordingly this work was begun June 29, and con-

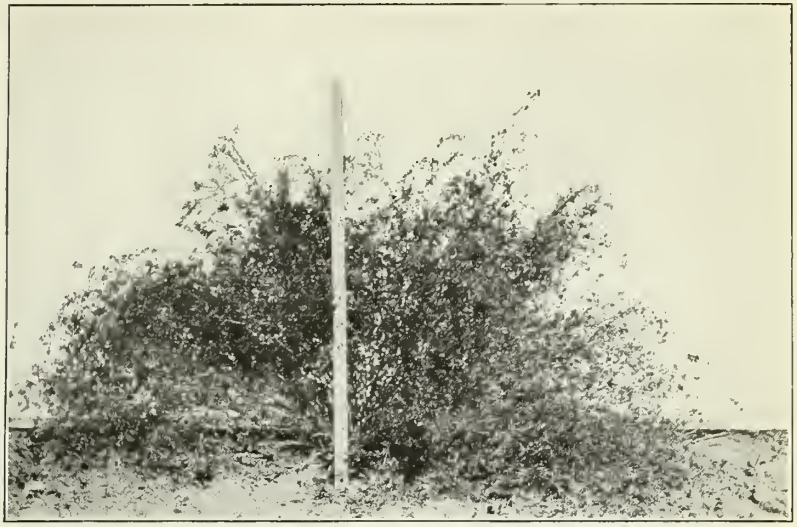

FIG. 1.—OMSK ALFALFA, MEDICAGO FALCATA, GROWN AT RAMPART STATION, 3-YEAR-OLD PLANT.

FIG. 2.—VARIATION IN PODS OF MEDICAGO FALCATA, GROWN AT RAMPART STATION.

FIG. 1.—ALFALFA GROWN IN ROWS FOR VARIATION STUDIES, RAMPART STATION.

FIG. 2.—VETCH, VICIA CRACCA, AT RAMPART STATION.

tinued until July 7. Several hundred individual flowers were cross-pollinated, using Grimm and *Medicago falcata* reciprocally. The production of seed on some plants was very low, while on other plants 25 per cent of the blossoms treated produced seed.

On one plant of Grimm alfalfa a number of flowers were treated with pollen from a native plant having trailing stems and bearing papilionaceous flowers on racemes of about an inch in length. The buds of this plant were purple, the open flowers blue. The triangular seed pods contained an average of 4 seeds. From this cross 56 seeds resulted.

A beginning was made of cross-breeding winter wheat. Nine heads of Kharkov were hybridized with pollen from Sandomirka, a Russian variety that promises well, having smooth heads and being apparently quite hardy. It is also a few days earlier than Kharkov. Kharkov winter wheat has been grown here for nine years, and careful selections have been made each year in an endeavor to develop a hardier strain, but with no appreciable success. From 75 to 85 per cent is winterkilled every year. It appears that what is grown here is a pure line, and that the limit of inherent hardiness has been reached. By crossing it with the hardier and earlier Sandomirka wheat, hybrids having the desirable qualities sought will, no doubt, be obtained.

Of new hybrids grown for the first time this year, there are: Oats, 20; spring wheat, 98; and spring rye, 104. Only one or two of each appeared promising. However, since the splitting up into types seldom occurs to any great extent in the first generation, all will be seeded again. From this second generation, single-head selections will be made.

Last year a few of the hybrid barleys of the fourth generation bred true, and this year there were several more. Two hybrid oats in the third generation and one variety of spring wheat also bred true. These continue to promise well. In a couple of years there will be sufficient seed from these hybrids to sow comparative test plats, using standard oats for comparison.

GRAIN SELECTION.

In order to establish pure lines, single-head selection was rigidly adhered to this year. Earliness, strength of straw, size of head, and sterility were the chief points considered in making the selection. Generally more than one head of a variety was selected. Each head was placed in a manila envelope and a descriptive tag placed in a slip on the envelope. In the spring the date of planting and plant number are added to the description on the tag, which is slipped into clips on the field stake. A duplicate record is kept in the field notebook. Each head will be planted in a separate row, using a definite and uniform number of kernels for each genus. Field notes will

be taken as heretofore, and, in addition, the progeny of each head will be weighed, straw and grain separately, and plant averages taken. By means of these data, selections will be made for the next season.

SPRING WHEAT.

Exclusive of the first-generation hybrids, 12 varieties of spring wheat were grown. The varieties and per cent ripe by August 20 are as follows: Chogot, 100; Irkutsk, 100; No. 306, 100; hybrid 24 A 1, 100; hybrid 24 A 2, 100; Velvet Chaff, 10; Ladoga, 5; H. G., 100; Marquis, 5; Early Java, 5; Ulka, 50; Romanow, 5.

Chogot and Irkutsk are very similar, having short, fine straw, small bearded heads, and small, flinty, angular kernels. They ripened in 88 days, from May 1 to July 27, inclusive. In 1914 these two varieties were cross-fertilized. As previously remarked, the progeny did not exhibit any marked variation or earliness, but many heads of the progeny were remarkably well filled, many spikelets having 5 grains and some 6 grains, making a short, broad-looking head, whereas the parent heads are typically short and slender. In point of earliness Chogot and Irkutsk leave little to be desired, but the heads are small and the straw short. Also, under field conditions, there would be considerable loss from shattering. These faults will be corrected if possible.

No. 306 is another Russian bearded wheat, practically identical with Chogot. It was said to ripen in 90 days, but like Chogot, it ripened in 88 days.

The two hybrid wheats, the one bearded and the other smooth, are both vigorous, producing large, well-filled heads only a few days later than Chogot. In their third generation these hybrids are still splitting up into bearded and smooth types. They are the progeny of Red Fife and Ladoga and are earlier than either parent, especially the Red Fife, which is altogether too late-maturing for this locality.

H. G. spring wheat is another Russian variety, grow here for the second season. It is bearded and a fairly vigorous grower, having well-filled heads with medium-sized, plump kernels. It ripened four days later than Chogot.

Ulka is a smooth wheat from Russia, having light-colored glumes and large, plump kernels in well-filled heads. It ripened unevenly and about a week later than the earliest variety grown.

In point of earliness there is not much choice between Marquis and Red Fife. In Marquis, the heads, although well filled, are quite pointed and the spikelets widely separated. The kernel is short and plump.

Romanow, Velvet Chaff, and Early Java are all late. Romanow has been tried here repeatedly and has never ripened satisfactorily. Velvet Chaff produces fine, large, smooth heads with large, plump kernels. This variety may prove valuable in cross-breeding.

Some of the varieties described above are illustrated in Plate XI, figure 1.

WINTER WHEAT.

August 5, 1914, some trial plats were seeded on a lowland tract. A good stand was secured and the fall condition was fair. In spite of the mild winter and the light snowfall, the ground was covered with snow from the first fall until the middle of April. Nevertheless, one variety, No. 206, froze out completely, while only 5 per cent of Klondike and 20 per cent of Kharkov survived. Sandomirka gave a 95 per cent stand. This was the second trial for No. 206 and Klondike, and neither did any better than on the first trial. Kharkov has been grown here nine consecutive years, careful selections having been made each year, but with no resultant gain in hardiness. Kharkov has long, stiff, widely spreading beards. The grain is fairly hard, but not so hard as the spring wheats Chogot and Irkutsk. The straw of Kharkov is weak, some years all lodging. A few ripe heads were selected August 12, but the bulk of the plat was not ripe until the end of the month.

Sandomirka is a Russian wheat given a first trial this year. Its hardiness is gratifying, and it is also a trifle earlier than Kharkov. It proved to be an impure strain, some heads being light and some dark and all having a few terminal beards only. The heads are medium-sized and pointed.

SPRING RYE.

Small plats of three varieties of spring rye were seeded May 1. These were Irkutsk, Gesselberg, and Mammoth. Irkutsk was harvested August 19 and was the earliest of the three, with Gesselberg a close second and Mammoth 10 days later. None was so early as the earliest winter rye, nor were the heads so well filled. Many of the spring rye heads were 50 per cent sterile. An attempt is being made to correct this fault by head selection and cross-fertilization. One of the first generation hybrids, the progeny of Mammoth and Irkutsk, had well-filled heads and the earliness of Irkutsk. During the process of the splitting-up of the second generation others may be found with like qualities.

WINTER RYE.

Winter rye and winter wheat were sown on the same date and in adjoining fields. This was all new land on the river flat or first bench. Some of it was rather wet because of seepage from partly

cleared land above. As far as could be observed the water standing on the rye field in the spring did not injure the stand. One and one-fourth acres were seeded to the following varieties: Brandon, Station No. 195, Monster, North Dakota No. 959, Giant French, Amber, No. 1134, No. 12890, Irkutsk, and No. 281. In point of hardiness there is little difference in these varieties, all giving practically perfect stands on ground where the snow remains until spring. On exposed slopes, where the snow blows off, as might be expected, the winter rye can not withstand the long exposure to the dry cold. All the varieties did well and ripened thoroughly, but there was a difference of 12 days in the ripening. Irkutsk, Giant French, Amber, No. 959, Monster, and Station No. 195 all ripened by August 12, Brandon a couple of days later, while Nos. 1134, 12890, and 281 did not ripen until August 24. Obviously the early ripening quality is a valuable one, because if cut the latter part of August it is very hard to cure grain thoroughly before freezing weather comes on, especially if the precipitation is above normal, as it was this year. Careful head selections were made of all varieties. Growing in one plat, No. 281, was found one plant having quite unusual heads (Pl. XI, fig. 2). The spikelets were abnormally developed, giving the head a bushy appearance and increasing the size of the head and the number of kernels quite appreciably. One head contained 103 kernels, while the best normal head in the plat had only 44 kernels, which gives a hint as to the increase in yield if the abnormal head could be bred true. The heads were saved and will be planted separately.

The following early varieties were cross-fertilized: Station No. 195 with North Dakota No. 959, Giant French with Amber, and North Dakota No. 959 with Giant French.

OATS.

Except for the oats seeded for hay (Pl. VII, fig. 1), only experimental plats of this cereal were grown. It is no longer necessary to demonstrate that oats can be ripened successfully here. Past and present experiments leave no doubt on that score. The work in connection with oats differs not at all from the work at experiment stations in the States. It is a question of finding the varieties best suited to local conditions, and the time-honored method of elimination by trial remains the fundamental way. Failing to find just what is adapted to the locality, hybridization is resorted to. The first essential here is earliness, and with this quality in view over 50 varieties and strains have been tested at this station. Most of these have been drawn from northern countries. While many of them were early enough, they lacked the vigor to produce a good length of straw and proportionate heads. However, several varieties have

FIG. 1.—SPRING WHEATS GROWN AT RAMPART STATION. FROM LEFT TO RIGHT, VELVET CHAFF, ULKA, MARQUIS, HYBRID NO. 24A, AND RED FIFE.

FIG. 2.—SPORTS OF WINTER RYE (NO. 281), RAMPART STATION. ORIGINAL TYPE AT LEFT.

FIG. 1.—HYBRID BARLEYS, RAMPART STATION. MALE PARENT ON RIGHT. FEMALE PARENT ON LEFT.

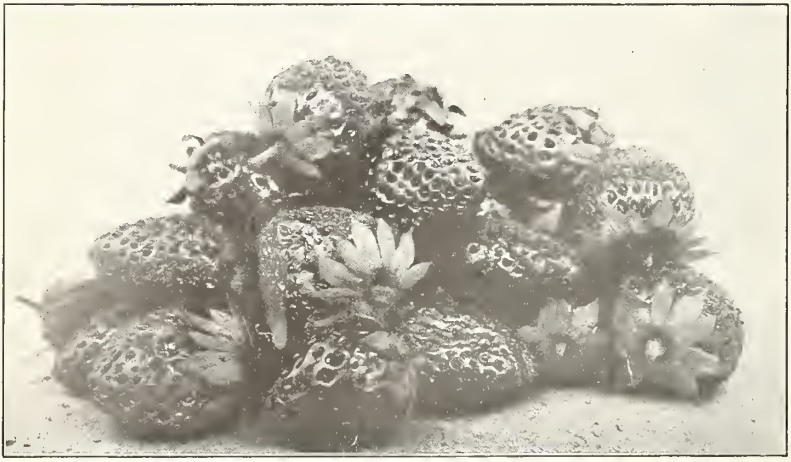

FIG. 2.—STRAWBERRIES GROWN AT RAMPART STATION. SITKA HYBRIDS NOS. 1503 AND 275.

come up to the severe conditions imposed and have been accorded a permanent place on the list of eligibles. Foremost in the list are Finnish Black, Norwegian, and South Dakota No. 637, all black, vigorous, and early, ripening this year in 95 days, last year in 94 days, and in 1913 in 88 days. White oat varieties that have done reasonably well are New Swedish and Hansen No. 278. The latter especially has fine large heads containing as many as 114 kernels. Unfortunately both are fully a week later than Finnish Black.

Hybrids 25 A 1 and 25 A 3 ripened in 94 days and were the first oats ripe. No. 25 A 1 has black kernels covered with a purplish bloom, and No. 25 A 3 has gray kernels. Several plants of the latter had side shoots growing from the first joint on the main culm. These supernumerary heads were smaller than the central head, but ripened nearly as early. The total number of kernels on a culm ranged as high as 120. These hybrids have been grown for three years, and this year came true. They are the offspring of a cross between Copperfield and Toholampi, the former a gray mutant of Finnish Black, the latter a strain of the same variety.

The following have similar growth characteristics: Minnesota No. 261, Orloff, Ontario, Rnakura, Russian No. 409, and Beliak. The straw is short and the heads quite small. Furthermore, none are early. This is the second trial for them here, and the first was equally disappointing.

This year a variety of hull-less white oats was grown for the first time from seed obtained from the Agricultural Experiment Station at Pullman, Wash. This oat made a very satisfactory growth. Seeded May 1, it was ripe August 18, requiring 110 days to mature. Unless an earlier strain can be developed it will be of little value here.

Black Tartarian and Banner were grown in pedigreed plats. Both are valuable sorts as regards yield and length of straw, but are also late, requiring 110 days for maturing.

BARLEY.

As usual, this cereal did well. In every one of the 43 plats the grain fully ripened. Pamir and hybrid 20 B were again close competitors for first place in time of ripening. Pamir led by one day, ripening in 79 days. In 1914 both ripened in 79 days; in 1913 in 71 days. Each year they have been the first barleys to ripen. This year only a few standard varieties were grown, such as Manshury, Primus, Boehmer, Hull-less S. P. I. 19851, and Pamir mentioned above. All have been described in former reports. These varieties serve as standards with which to compare the hybrids.

A number of hybrid barleys of the 6-row, hooded, hull-less type are making a creditable record and are breeding true (Pl. XII, fig. 1).

Only comparative field trials can demonstrate their true worth. Meanwhile new hybrids will be created, the number being limited each year by the amount of time available for this crop.

Only three varieties of barley new to this station were tried this year—a white, bearded Russian sort (No. 409) having short straw and small heads and ripening late, and a hooded hybrid barley, Eureka, and a winter barley called Tapps, both from the Agricultural Experiment Station, Pullman, Wash. Eureka lacked the characteristic vigor often found in hybrids. It grew to a height of only 27 inches, bearing medium-sized heads and requiring a comparatively long period for ripening. Tapps sowed here in the spring and headed June 29 was ripe August 18 and 25 inches in height. The heads were heavily bearded and tapering. This variety appeared identical with a spring variety grown here under the name of Finland, station No. 121. The latter is, however, more vigorous.

BUCKWHEAT.

On May 2 three plats of buckwheat were seeded. Two of the varieties, station Nos. 60 and 71, have been grown here for several years, and even in the most adverse season, when they were killed by frost August 14, 1913, they have ripened a fair percentage of seed. This year the frost-free period being above normal both varieties ripened practically all of the seed set. The seed clusters, particularly on No. 71, which is of Japanese origin, were very large, containing as many as 60 grains each. Both of these varieties have white blossoms. The other variety grown, station No. 138 (seed originally from Malta, Province Irkutsk, Russia), has pink blossoms. While all three varieties began to bloom on June 26, scarcely 50 per cent of the seed of No. 138 ripened. Although grown side by side, this variety exhibited greater vigor than did the other varieties.

HEMP.

A trial plat of hemp from seed of Russian origin, planted May 2, was grown for the first time at the station. It gave evidence of not being of pure line. The growth was uneven, the plants ranging in height from 20 to 36 inches. On August 10 about 2 per cent of the seed was ripe and was gathered by shaking the plants over a shallow vessel. The plants were uninjured by the frost of August 20, and when cut September 4 about 50 per cent of the remaining seed was ripe.

FLAX.

Ten varieties of flax were grown, 9 of which were from station seed raised last year and selected from 14 varieties tried. None of them did very well either last year or this. Their growth is short, and

all are too late in maturing. The tenth variety is a new one grown from seed of Russian origin. While no taller than the others, it matures much earlier. Seeded May 2, 50 per cent of the seed was ripe by August 18, and by the end of the month fully 90 per cent had ripened.

BROAD BEANS.

For the second time the following varieties of broad beans were tried: Beck's Dwarf Green Gem, Murciana, S. P. I. No. 24174, Sutton's Green Giant, and Pamsca. Planted May 2, they did not come up until May 25, although the seed was well soaked before planting. The first blooms appeared June 24. All varieties grew well-filled pods, none of which ripened, and the plants lacked vigor. These beans are not appreciably injured by light frosts. From the standpoint of forage-crop production they are a failure.

STRAWBERRIES.

The hybrid strawberry plants received from the Sitka Station August 5, 1913, have now passed through two winters. Both years the plants were given a winter protection of brush and straw. Winter hardiness ranged from 0 to 100 per cent the first winter. The second winter none exhibited 100 per cent hardiness. Perhaps the covering was removed too early last spring, and, like the alfalfa, the plants suffered from the prolonged spell of freezing and thawing weather which marked the transition from winter into spring this year. In spite of this, hybrids Nos. 275, 1503, and 320 showed only a small amount of winter injury, grew well, and runnered freely. No. 320 began blooming June 20. No. 275 appeared slightly hardier than No. 1503, but the latter bore considerably more fruit. The fruit of both Nos. 275 and 1503 fully ripened by the middle of July (Pl. XII, fig. 2). While the berries were undersized as compared with fruit from the same varieties grown at Sitka, they were firm, aromatic, and well flavored, and far superior to the native strawberry, a small plat of which is maintained for future hybridization in connection with the Sitka hybrids.

THE GARDEN.

The usual garden vegetables were raised, giving satisfactory results. The plat of ground used has a gentle slope to the southeast and dries off quickly in the spring. This year it worked up dry and mellow April 29 and was seeded the next day. This gave an unusually early start with a correspondingly long season. Turnips grew to an immense size, eight of the largest weighing 106 pounds. The largest individual turnip, Yellow Finland variety, 3 feet in circumference and weighing 17 pounds, was solid throughout.

Only 1 per cent of the parsnip seed grew, but that produced fine roots, one of them 17 inches long.

The carrots, including Danvers Half Long, Chantenay, James's Intermediate, Oxheart, and Champion, all proved good under dry weather conditions. The first three are practically identical, medium in length, and well flavored. A number of them grew to a large size, 9 and 10 inches in circumference. Champion is a yellow sort and very mild in flavor.

The garden peas, Alaska and Nott's Excelsior, station-grown seed, were not planted until the middle of May. Earlier plantings would have been better. The dry weather gave them a setback, but by July 1 the pods were table size, and by August 1 a number of the pods were ripe. Where left entirely for seed production, about 50 per cent of the seed ripened.

In a plat adjoining the garden, several varieties of apple trees were set out in the spring of 1906. The only survivors are three trees each of Siberian Crab and Yellow Transparent. These have grown into small, low bushes, the largest, a Siberian crab, with a spread of 5 feet and a height of 30 inches. This tree bore two clusters of blossoms, several of which set fruit, but these dropped off one by one before they were one-half inch in diameter.

POTATOES.

One acre was planted with potatoes May 14 and 15. Two years before part of this ground received a light dressing of very coarse stable manure, and because of a lack of manure, straw was used to finish the field. The field was cropped with barley and fall-plowed last year. As fall rains were very light in 1914, followed by unusually light snowfall, this soil, mixed with straw only partly decayed, remained quite loose. The ground was, therefore, in poor condition to carry a crop through the dry weather of May and June. During August abundant rain fell, but too late to be of material benefit to this crop. All potatoes before planting were given the formalin treatment for scab (1 pound formalin to 40 gallons of water), which had made its appearance the previous year. No scab was found this fall. Burpee's Superior and Irish Cobbler were the main crop varieties. In order to test the value of seed pieces cut to a single eye, one row each of the above varieties was planted with single-eye seed. Upon weighing the yields at digging time the results proved contradictory, inasmuch as Burpee's Superior showed an increase of 3.22 per cent in favor of the large seed piece and Irish Cobbler 20 per cent in favor of the single eye. Burpee's Superior is, on an average, a better yielder than Irish Cobbler. It is also smoother and has a better shape for baking, being flat and long. The largest this year was 8 inches long, solid, and without a blemish. Further-

more, it is less affected by scab, but in point of earliness and in cooking quality it is inferior to the Irish Cobbler.

Twenty-nine new varieties of potatoes were tried this year from seed received from Sitka. Having been dug early in order to reach this station before the close of navigation, the potatoes were badly bruised and wilted when received. Consequently the first year was not a fair test. For that reason no report is made on them for this season.

The varieties are Bovee, Happy Medium, Snowflake, Olds's Prolific, Beauty of Hebron, Admiral Dewey, Rusty Coat, New Snow, Extra Early Wabonsie, Early Puritan, White Star, New Queen, Northern King, Burpee's Extra Early, Spaulding, Freeman, Red River Acme, Early White Albino, Livingston, Scotch Rural, Uncle Gideon's Quick Lunch, First Early, Sir Walter Raleigh, Clyde. Good Times, Rose of the North, Pride of the South or White Bliss, May King, and Early Thoroughbred.

REPORT OF WORK AT KODIAK LIVE-STOCK AND BREEDING STATION.

By M. S. Snodgrass, *Assistant in Charge.*

The work at the Kodiak Station has progressed favorably along the lines laid out in former reports. A very unusual drought occurred here during the late spring and early summer months, which very nearly resulted in a failure of native hay grasses on meadows cut the previous year. Late rains revived the grass somewhat, but the yield was less than half a normal crop of hay. The grain-hay crop was damaged by the drought to some extent on the hillside fields, where the old soil and volcanic ash have been thoroughly mixed, and was a complete failure on the volcanic-ash flats. Pasture lands were not affected so noticeably, owing to the mulch of old grass covering the ground, but this grass turned brown by August 1, and the succulent pasture grasses, of which this country can usually boast all through the summer, became tough and ripened. Milch cows fell off in milk flow and beef stock did not put on flesh as in former years. The second growth of grass after the rains began furnished fair pasture during the fall and stock are doing well.

The erosion of the volcanic ash continues as during the year previous. The rains of November and December, 1914, thawed the surface of the ground and carried heavy deposits of ash from the mountains and hillsides, making ever-changing creek channels through the flats in the valley. Overflows on the meadow lands cut new channels through the ash, left deposits in new places, and caused an ever-changing surface over which to travel and work.

Where the grass is well sodded there are usually deposits of ash, while the water often cuts small channels through the bare places and thinly seeded grass patches.

The work of improvement and building was continued during the spring and summer. A calf pasture was fenced at Kodiak and a fence of woven wire placed around the garden and nursery plat. Two acres of stump land was cleared by means of block and tackle and a team of horses. This land was seeded to pasture grasses. Two hundred and forty rods of pasture fence was put up during the season and considerable improvement was made in yard fences.

The work of building was begun soon after July 1 and continued during the summer. An addition, 20 by 16 feet, was built to the cottage at Kalsin Bay and the attic rooms finished in the whole cottage, thereby giving room for the foreman and his family. A wagon and stock scales were added to the equipment there, making it possible to keep accurate records of feed raised and used and of gains or losses of weight in all live stock and to carry on feeding experiments. Wooden stanchions for 30 head of cattle were built in the cattle barn at Kalsin Bay, and arrangements were made for feeding and stabling all the cattle. The mangers were moved from the side of the barn to the center so that cattle may be kept on both sides, thereby increasing the manger room to accommodate 40 additional head, but giving less room for the cattle to walk about under shelter.

The painting of buildings was begun this summer and is to be continued until all are painted. Half enough paint for this job was purchased this year. The necessity for painting both walls and roofs of all buildings every four or five years is due to dampness of the climate. All shingle roofs soon become covered with moss if not kept painted. Metal roofing rusts quickly in the salt air, and the paper roofing material, cut and worn by the blowing ash, absorbs water and quickly deteriorates. All unpainted frame buildings weather rapidly.

At Kodiak an addition to the dairy building, 16 by 16 feet, was erected for a permanent dairy room. One room of the building had been given over to the man in charge of the dairy. Additional equipment for the dairy was purchased this year, and it is now fairly well equipped for experimental dairy work. A machine shed, 24 by 30 feet, containing a tool room and blacksmith shop below and a workshop above, was completed and occupied this fall. It affords shelter for all farm machinery kept at the dairy station. A calf stable, 16 by 20 feet, equipped with feeding stanchions for small calves, was also built. Good ventilation and light are provided through windows on the south side of the building. The painting of the buildings was begun this fall, but was not completed, owing to lack of paint.

A 48-foot gasoline boat was purchased at Sitka for Kodiak Station and equipped with a 35 to 40 horsepower engine. It was brought from Sitka to Kodiak under its own power, a trip of nearly 1,000 miles. The trip was made without mishap to the boat and without any engine trouble whatever, notwithstanding the stormy weather and rough seas. The boat had formerly been used in the fishing business; therefore, it had to be remodeled inside and made suitable for the work required of it at the station, namely, towing and carrying freight between Kodiak and Kalsin Bay. The boat is strongly built and seaworthy, and affords a safe means of travel between the two stations. Some minor changes are yet necessary to make the boat suitable for the work in hand.

The writer was absent from the station from May 25 to June 27, making a reconnaissance of agricultural land in the Matanuska Valley and selecting a site for an experiment station. The selection of 240 acres of representative land was made 2 miles northwest of the junction of the Fairbanks and Matanuska branches of the Government railroad now under construction.

CLIMATIC CONDITIONS.

The climate, which is one of the most important factors entering into the agricultural development of this country, is also the most uncertain. While the average annual precipitation, number of cloudy and rainy days, and the number of clear and sunshiny days remain fairly constant year after year, the seasons vary greatly in these respects. Snowfall is the most uncertain quantity, ranging from 25 to 100 inches during the past 8 years, the average being between 3 and 4 feet during the winter and early spring months. The snow seldom reached a depth of 2 feet and remained on the ground not more than 3 to 6 weeks at one time. Usually the snow is melted by a rain closely following the snowfall.

The temperature seldom falls as low as zero at this station, but it has been known to fall to 12° below zero for a very short period. The clear weather during the winter is always colder than the cloudy weather, but the sunshine more than makes up for the cold. Cloudy weather always means a rise in temperature and a very uniform and even range from 30 to 40° F. Westerly winds usually accompany clear days, and at times become gales that are very unpleasant both on land and sea. Transportation about the island is principally by water and at times is absolutely impossible during such gales.

The lack of snowfall during December, only 12 inches during January, 7 inches in February, and 3 inches on the last day of March gave an open season, allowing sheep to range all winter and cattle for the greater part of it. The rainfall during this time was over

35 inches, which is nearly double the normal precipitation for these months. April weather was normal—wet and cold with very little sunshine. May was dry, there being only 1.91 inches precipitation. The sun shone clear and warm the first part of June, followed by cloudy weather and light rains, the precipitation for the month being 3.66 inches. July was very dry, with only 0.58 inch of rain, clear weather prevailing throughout the month.

Grass came up early in the spring and made rapid growth. Sufficient pasturage for cattle was produced by April 20, but the growth was slow in June and July, much of the grass turning brown by the middle of July. Grass in the meadows was stunted by the dry weather, making less than half a crop. The drought was broken August 4 and for four weeks rain fell every day, the precipitation for the month being 10.52 inches. Grasses began a second growth at this time and pasture was considerably improved. Noticeable growth was apparent in the native bluetop (*Calamagrostis langsdorfi*) and a second crop of seed stalks appeared late in August. The growth was uneven on meadows cut the previous year.

September weather was anything but favorable for making hay, showers and sunshine alternating, with only one clear day during the month and only eight days on which rain did not fall. There was in October 4.66 inches of rain, with 21 cloudy days. A killing frost came on October 12. The growing period for the season was longer than normal and on the whole was favorable to crops. Cultivated crops did not suffer from the drought as did those growing wild. The early part of the season was too dry for shallow-planted garden seed, many of the seed lying in the ground a month before germinating. The season was favorable for growing potatoes and late planting of root crops. Many of the early planted roots were badly damaged by worms. Insect pests did more damage to gardens this season than ever before, owing, perhaps, to the favorable weather conditions for their breeding.

CROP WORK.

Field work was begun April 12 at Kalsin Bay and April 20 at Kodiak. The frost was out of the ground early in March, but the heavy rains during March and the first half of April kept the ground too wet for plowing. At Kalsin Bay the subsoil is of gravel and the ground is in condition for plowing several days ahead of that at Kodiak, which has a subsoil of heavy clay.

The deep-cutting gang plow was used on the level land at Kalsin Bay, where 23 acres of bench land was plowed and prepared with disk and smoothing harrow for seeding to oats, mixtures of grass seed being sown with the grain. On the hillside fields at Kodiak the hillside plow was used again this season with good results. It

FIG. 1.—OAT FIELD, KODIAK STATION.

FIG. 2.—COW KALE, KODIAK STATION.

FIG. 1.—CUTTING OATS FOR HAY, KODIAK STATION.

FIG. 2.—LOADING HAY, KODIAK STATION.

was possible to plow deeper than in previous years and more of the old soil was turned up. The disk and harrow followed the plow and the mixture of the volcanic ash and the old soil is quite complete. The result is a friable, sandy loam soil, which warms up quickly in the spring and holds heat well. Fifteen acres of this hillside land is now under cultivation. Clearing away scattered trees and stumps and hauling rocks from this land necessarily entails a great deal of work in preparing for cropping. Each plowing brings up many small stones, which are hauled off every year.

Spring seeding was begun on May 5 at Kalsin Bay and May 15 at Kodiak, and was finished June 1. At Kodiak 15 acres was seeded to oats and barley (Pl. XIII, fig. 1). All lands seeded were given a light dressing of manure or nitrate of lime at the rate of 240 pounds per acre. The manure was spread on the land during the winter and early spring, while the nitrate of lime was applied after the grain was up. The grain drill was followed by a land roller or pulverizer, which left the ground in good condition.

Cow kale was grown on the above-described soil this season with marked success (Pl. XIII, fig. 2). The methods of setting out kale grown in cold frame and planting the kale in hills were tried this season with little difference in results. The dry weather of the early summer retarded the growth of the reset plants, while the seed planted in hills did not germinate until late in June. The growth was slow until the rains of August came; then it was rapid, continuing until freezing weather. The plants did not reach the size attained in the warmer climates, but were thrifty and made a fair yield. In this country the kale furnishes a succulent feed for dairy cows as the pasture grasses fail, and fits well in the feeding scheme before the silo is opened. Between 6 and 7 tons of kale was grown on a half acre of land which received a very light dressing of manure.

The deep-plowing gang plow was tried this year on the bench and bottom lands at Kalsin Bay with only moderate success. The lack of horse power made it impossible to plow to sufficient depth to turn up enough of the old soil to make a proper mixture with the volcanic ash to give a good soil for plant growth. All manure available was spread over this land and plowed under. In spots where the ash was not more than 6 inches deep enough of the old soil was turned up and mixed with the ash to demonstrate that grain crops can be grown on the mixed soil, while very little can be grown on the ash alone. Where there is sufficient manure added to the ash, certain crops may be grown with fair success, but as yet the volcanic ash has not sufficiently weathered to become good soil. Where humus is added from year to year the plant growth on the ash shows decided gains.

The work of restoring vegetation on the deep volcanic ash this season consisted of seeding 23 acres of mixed grass with the oats seeded for hay on the land described above. A good stand was secured on the most of this land, but only fair growth was attained by the plants. The drought of the early summer affected the grass quite as much as it did the oats and barley. The effect of the manure on either grain or grasses was not noticeable until late in the growing season. A surface dressing of manure gives better results on newly seeded grasses, as shown by small plats seeded each year since the ash fall, the available plant food of the surface manure being more readily taken up by the grass roots than that from manure plowed under.

Oats for hay and silage, seeded May 15 to June 1 on hillside land cropped the past two years and given a dressing of 240 pounds nitrate of lime per acre, made a fair growth, headed, and filled well, being in the dough stage September 10. The stand was fair, with short straw, but well-filled heads. The yield was estimated at 1½ tons hay per acre (Pl. XIV, figs. 1 and 2). Oats grown on hillside land and receiving a light dressing of manure made a rank growth of straw and filled well, but lodged badly late in August. The yield here was about 10 tons silage per acre. Fifty bushels per acre was the estimated yield of grain on this plat. Oats seeded May 15 and maturing September 15 began to shatter badly. The grain was plump and heavy. All oats were badly damaged this season by smut, which appeared with the first heads and gradually developed until fully one-tenth of all heads was affected. The seed had been purchased in the open market at Seattle and had not been treated for smut. As this was the first appearance of smut at this station, no attention had been given the matter.

Vermont bald barley seeded the latter part of May on hillside land made better growth than during the previous season. The straw was short, with medium-sized, well-filled heads. This barley was mature September 10, at which time it was cut for hay, the yield being estimated at 1¾ tons per acre. Calcium nitrate was again used, with poor results on barley.

Rutabagas, seeded May 25 on well-manured volcanic ash and clay-loam mixture, made remarkable growth this season. Rutabagas weighing 12 and 15 pounds each were very common. The yield per acre at this station is estimated at 35 tons.

Turnips made an unusual growth this season but were badly infested with root maggots. Practically all of the early seedings were unfit for use. Late seedlings, however, were nearly free from maggots and made a good yield. The Petrowski turnip proved to be the best turnip for this region. It is freer from the root maggots than other varieties and better in quality.

Mangel-wurzels seeded May 25 in a well-manured plat of volcanic ash and clay loam soil made fair growth of uniform roots. Only a very small plat was grown in the garden this season. The yield was sufficient to warrant further work with mangel-wurzels on a larger scale another year.

POTATOES.

A variety test of potatoes begun last year was continued this season. Duplicate plats of the four best producing varieties of last season's crop were planted on hillside land of mixed ash and clay loam without manure, and on volcanic-ash soil with a heavy dressing of manure. Those grown on the hillside without manure were nearly a failure again this season, showing that the soil here needs fertilizer for growing potatoes. All four varieties grew well in volcanic ash which had received a light dressing of manure the two previous years and a heavy dressing this spring before seeding. The varieties tested this year were planted on a slight southern slope in rows 3 feet and 2 feet apart in the rows. The potatoes were sprouted before planting, with care taken that the sprouts were not broken off in planting. The results are given in the following table:

Yield of potatoes at Kodiak Station, 1915.

Variety.	Date planted.	Number of hills.	Yield of good potatoes.	Calculated yield per acre.
			Pounds.	*Bushels.*
Burpee's Superior	May 5	104	239	250
Clark's Alaska Seedling	do	108	217	220
Extra Early Ohio	do	197	341	192
Irish Cobbler	do	112	147	144

The Irish Cobbler and the Extra Early Ohio varieties gave a yield more uniform in size and smoothness than other varieties, while the heavier yielders, Burpee's Superior and Clark's Seedling, were more irregular in shape, and many of the larger potatoes were found to be hollow. The two last-named varieties were much slower in maturing, and the quality of the potatoes was inferior to either the Irish Cobbler or the Early Ohio.

The method of planting and cultivating potatoes generally folfowed in this country is to make up long beds 4 to 5 feet wide and 1 foot high, and to plant the potatoes every 12 inches apart each way. Very little cultivation is possible after the potatoes are 6 inches high. The principal fertilizer used consists of kelp and seaweed placed in the bed about 6 inches below the surface as it is made up. The potato seed is planted in the soft earth just above the kelp by means of a sharp stick and is covered by hand or foot.

Heavy yields are often secured by this method of culture, but the percentage of small potatoes is usually large and the potatoes are slow in maturing.

The method of planting in rows and cultivating common in the States gives the growing potatoes a better chance to grow and mature than when planted so close together in the beds. If the seed is planted shallowly and the soil is gradually hilled up around each plant as it grows, the effect of making up the bed is obtained for each hill and row, and the soil in which the plant is growing is well drained and warms up as readily as in the bed.

That the volcanic ash is beneficial to the soil for potato growing is proved here beyond a doubt. The need of humus and other plant food is evident, and it must be supplied to some extent. The soil containing the ash warms up readily and is easily drained, and is much more easily worked than the clay loam soil below the ash.

VEGETABLES.

Vegetable gardening is becoming more popular each year since the volcanic ash fall. The garden soils have been much improved by the ash, and all kinds of vegetables ever grown in this country did exceptionally well this season. Early radishes were hurt somewhat by the dry weather, also lettuce, which had a tendency to seed when the rains came. Later plantings did well, however. Carrots, beets, cauliflower, cabbage, parsley, peas, and late turnips yielded heavily and were of the best quality possible. The late varieties of cabbage did remarkably well this season, many of the heads reaching 12 inches in diameter and 15 to 20 pounds in weight. Early varieties produced well, but were damaged some by August rains, which caused a second growth and bursting of the heads.

HAY MAKING AND SILAGE.

The drought of the late spring and early summer shortened the yield of native bluetop grass fully one-half. Wild rye grass, however, made good growth, but is too scarce since the volcanic-ash fall to afford any considerable quantity for winter feed.

The haying season began July 28 at Kalsin Bay, with only small scattering patches of grass mature enough to cut for hay. About 22 tons of hay was cut between July 28 and August 4. Seven tons of this was saved; the remainder was lost on account of the rains, which began the evening of August 4 and continued every day for four weeks. During the month of September about 25 tons of bluetop hay was cured and put into stack and barns. Some 6 or 7 tons more were lost by rain. The grain that had been seeded for that purpose was mature enough for hay by September 10. Some

18 tons were secured and put in barns. About half of this was put in without getting wet, while the remainder was rained upon in windrow and cock, but was later dried out by heavy southwest winds. About 6 tons of wild-rye or beach-grass hay was cut early in October at English Bay, 8 miles from Kodiak, hauled to Kodiak in the skiff, and put into small stacks to cure, being later put in a hay barn. This wild rye contained considerable amounts of old dead grass, which reduces the feeding value about one-third or more, but the stock pick it over and relish the sweet, juicy stems.

Wild-rye grass cures very slowly in the driest weather, and retains considerable moisture in the stems. The practice of cutting wild-rye grass late in the season and curing in large cocks is a very old the bulk of the hay used by the Russian people, who have maintained cattle on it on Kodiak Island for the past hundred years. The old dead grass should be burned late in the fall, if possible, so as to avoid the trouble it gives in cutting and curing the hay. After the first year's cutting, however, there is little trouble from this source.

The silage cutter was started August 17, and two silos at Kalsin Bay were filled with bluetop mixed with fireweed and wild-rye grass during wet weather. After bluetop grass begins to cure it is difficult to cut with the silage cutter. The knives must be kept very sharp and keen to cut such grass. To be able to perform the work rapidly it is necessary to cut the grass in the field and haul direct to the silage cutter. The more succulent and tender the grass, the better the cutter handles it. Wild-rye grass is very hard to cut if it contains any old dead grass, and the silage cutter will not handle it at all.

About 135 tons of silage was secured, of which 115 tons is of mixed bluetop and fireweed and 20 tons is of beach grass. About 10 tons of beach grass was put into the silo without cutting.

At Kodiak, about 18 tons of oat silage was put up and 16 tons beach grass. The beach grass was not put through the cutter because of the dead grass it contained. It was cut at English Bay and on Kalsin Island, and hauled in the skiff 8 miles to Kodiak. The scarcity of beach grass since the ash fall necessitates the moving of haying machinery and teams from place to place wherever a few tons can be secured. The moving of machinery and teams is done in a skiff towed by launch. The silage cutter with the engine also has to be moved from Kodiak to Kalsin Bay and back again each season so as to fill the silos at both stations. This moving of teams and machinery requires considerable time and smooth waters. The loading and unloading is done on the beach by means of gangplanks over the stern of the skiff. Heavy machinery is loaded by means of block and tackle and team power.

RESTORATION OF VEGETATION ON VOLCANIC ASH COVERED LANDS.

The natural restoration of vegetation over ash-covered hills and valleys continues very rapidly. The small grass seedlings that appear wherever any protection is afforded give sufficient evidence that the barren wastes of volcanic ash covered flats will be covered with grasses in a very few years. Fireweed seems especially well adapted to the ash, and is fast gaining a hold everywhere on the hillsides and in many places on the flats. The fireweed in turn affords protection to the young grass seedlings. The dead stems of fireweed of last year's crop help to hold the ash from blowing and give lodging for dead leaves from weeds and trees, supplying plant food to the grass seedlings. Grasses are to be found in great numbers wherever the fireweed has gained a foothold. The grass plats that last year were free from fireweed showed considerable weed this season, indicating that it may be troublesome to hay land and meadows.

The seed of both the bluetop grass and the fireweed is borne by the wind to great distances. The small tuft of cotton like hairs attached to the seed insures its wide distribution. Other varieties of grasses are found growing on the ash in many places. Lupines seed heavily, and the seed scattered by the bursting of the pods usually find lodgment near the parent plant, but they are often carried by winds and water to lodge and grow in the deep ash on the flats in many places. The nodules containing nitrogen-gathering bacterial colonies are found on the young plants growing in the ash. The lupine grows more thriftily since the ash fall than before. It is more abundant than all other legumes native to Kodiak Island, and will be an important factor in adding nitrogen to the volcanic ash. The lupine is not eaten by cattle at pasture, but is readily eaten by sheep. When the plant is cut before it becomes too woody and is cured with hay it is relished by cattle. Some doubt exists among stockmen as to whether the lupine can be safely fed to stock, owing to the poisonous alkaloid found in the plant. No evil results have been observed at this station from feeding hay or silage containing lupine.

Wild-rye grass (*Elymus mollis*) continues to thicken up by means of underground runners or stems. Very little seed has been produced the past two seasons, but a few plants were noticed this year that had come from seed carried by water. The beach lands and tidal flats are slowly and surely being restored to their original productiveness in stock feed.

Grasses seeded the past three seasons have made slow growth, but they are gradually gaining hold upon the ash. Where a light dressing of manure has been given the land the grasses have responded readily and made fair growth. Considerable pasture was had this

season on grasses seeded in 1913. Grass seeded last year upon hillsides where the ash was mixed with the soil furnished very fair pasture throughout this season. A good sod has formed and permanent pasture is assured. A considerable amount of white clover caught on this land and did well this season. A few plants of alsike clover also came through the winter and did fairly well. All red clover was killed out during the winter.

GALLOWAY CATTLE.

The station herd of Galloways has continued to thrive well under the conditions existing since the ash fall. The greater portion of the herd was wintered at Kalsin Bay on native hay and silage and about 35 tons of oat silage put up the previous year. Three cows with their calves and the herd bull were wintered at Kodiak on native hay and oat silage. The cattle came through the winter in good condition, receiving only a maintenance ration.

The feeding period during the past winter, 1914–15, began November 1, when a light feed was given all the cattle at night and they were allowed to run on the range during the day. It was necessary to begin full feed November 15, and continue on full feed until April 1, and then gradually diminish the feed until April 20, when the stock got plenty of new grass. The milch cows were fed a month earlier in the fall than the general herd in order to keep up the milk flow as the pasture depreciated. Spring pasture was fully three weeks earlier than usual this spring, but summer pasture was not so good on account of the drought. The cattle gained in flesh rapidly and were fat by July 1. They made little gain in flesh after that date, but held their flesh well and are going into the winter (1915–16) in good condition. Fifteen calves, 6 heifers and 9 bulls, were dropped this season. One bull calf died from an unknown cause. The small number of calves dropped this year is due to using the old herd bull, an uncertain breeder. This bull was discarded this year and sold for beef. Two cows died late in the winter (1914–15) from hepatitis (inflammation of the liver), due perhaps to their getting moldy silage. Trouble from an unusually rapid molding of the silage was experienced during mild weather, and the feeding of a smaller herd did not lower the silage fast enough to keep it from spoiling, so that it was necessary to discard much spoiled silage.

Seven head of bulls and steers were sold for beef and two bulls for breeders. The herd now consists of 28 cows three years old and over, 5 two-year-old heifers, 7 yearling heifers, 6 heifer calves, 1 three-year-old bull, 1 yearling bull, 2 yearling steers, and 8 bull and steer calves, making a total of 58 head on hand at this date.

DAIRY WORK WITH GALLOWAYS.

The dairy work was begun last spring as the cows became fresh. Nine head of cows were milked and records kept of each cow's performance. The milk was tested for butterfat only and the whole milk was fed to the calves. A few of the cows did fairly well for a beef breed and will be milked and tested another year. Three cows did so poorly that their condition will not warrant keeping them in the dairy herd another season. Cows that have suckled calves in former years do not respond to hand milking. Heifers coming fresh will be used in the dairy tests each year hereafter until their worth is proven and only four or five of the older cows that gave the best yields this year will be continued in the dairy. The heifer calves are handled from their birth until they become cows with the idea of making them tame. They are broken in in stanchions while being fed by hand and during their first, second, and third winter feeding periods. During the pasture months they are rounded up every night, corralled, and kept accustomed to being handled. Wooden stanchions were built this year to accommodate all the herd at Kalsin Bay. Most of the Galloways respond readily to handling and become quite tame and tractable. A few, however, will not get over their nervousness and inclination to kick.

Butter making and cheese making were not undertaken this year because the dairy rooms were not finished, the full equipment not being received until this fall. This work will be carried on another season on a small scale to determine the practicability of such work under existing conditions.

THE SHEEP.

The station flock of 14 ewes. 4 wethers, and 1 ram was wintered at Kalsin Bay. They were kept in corral and open shed after December 2. A maintenance ration of silage and hay, equal parts by weight, was given them until grass furnished sufficient feed after April 1. Fourteen lambs were dropped during the latter part of April and May, of which 7 ewe lambs and 4 ram lambs were saved, 3 being lost during the lambing season. To avoid having the remainder of the flock killed by bear they were moved from Kalsin Bay to Near Island, close to the village of Kodiak, for summer pasture. Bear were plentiful during the summer months on the ranges at Kalsin Bay, where such havoc among the sheep was played last season. The lambs made remarkable growth during the summer and the ewes are in prime condition. The four wethers were sold for mutton soon after shearing in the spring. The clip was of good staple and fairly clean, averaging 7 pounds per head.

SUGGESTIONS FOR FUTURE WORK.

The selection of a few cows and a bull of some recognized dairy breed of cattle for cross-breeding with the Galloways to establish a hardy dairy breed for Alaska will perhaps solve the problem much more quickly than selecting and breeding purebred Galloways. The Holstein breed naturally suggests the desirable type of cattle to use in cross-breeding for this purpose. The work of establishing a dairy strain of pure-bred Galloways will involve a long period of time and necessitate a considerable outlay of money and labor, which might be saved by judicious crossing and selection of the most desirable individuals resulting from such crossing. The practice of crossing both ways, using pure-bred bulls of each breed upon pure-bred cows of the opposite breed, could be carried out.

Horse breeding is most urgently recommended for this station, now that the development of a larger portion of the agricultural lands of Alaska is assured. Where pasture land is so plentiful, as on Kodiak Island, horse raising can be carried on profitably. At the present time practically all horses have to be shipped from the States. A few horses were raised at the Frye Ranch, near Kodiak, with very good results, prior to the volcanic eruption in 1912. The selection of a stallion and four young brood mares of the Percheron or other draft breed would furnish sufficient stock for a beginning. The station now has three mares and five geldings. The geldings should be transferred to the new station at Matanuska for the work of that station and other substations to be opened in the future. The brood mares could take the place of the geldings in the work of the station here. In this manner the breeding stock could be added at little extra cost and the new stations be supplied with necessary teams. The future need of horses for the Alaska stations could be supplied from our own breeding. All surplus horses will find a ready market among Alaska farmers.

NEW SETTLERS ON KODIAK ISLAND.

Two new settlers with their families took up homesteads at Uyak Bay, Kodiak Island, during the past year. They brought a full equipment of farm machinery, tools, teams, milch cows, hogs, chickens, and a flock of sheep. They settled upon Amook Island, in Uyak Bay, where they hoped to be free from molestation from the brown bear. It was soon discovered that the bear swam to Amook Island from the main island. Late in the summer the settlers found it advisable to move their stock and buildings to the head of Uyak Bay, where there was plenty of native grass for hay and winter pasturage.

A number of other homesteaders have taken up land during the past year with the expectation of shipping in live stock another season. Most of these homesteaders are miners and prospectors who came here for mining but were so favorably impressed with the stock-raising possibilities that they took up homesteads.

With favorable legislation regarding the brown bear on this island there is no doubt that the sheep industry will develop to considerable importance within a few years. With the constant danger of bear attacking the sheep, the settler is obliged to herd or fence for protection from the bear. It is hoped that Congress will recognize the rights and needs of the people of this country to such extent that the protection of the brown bear will be removed and that restrictions with regard to sale and shipment of bearskins will be so modified that there will be an incentive to kill off the bear on Kodiak Island. Much expense has been incurred at this station during the past year to protect the live stock from bear.

REPORTS FROM SEED AND PLANT DISTRIBUTION.

Those who read this report for the information it may give them concerning Alaska are advised not to omit the following letters, which have been received from many quarters of the Territory. They deal with facts as the actual settler finds them. They should furnish a valuable guide to those who contemplate settling in the Territory.

Fred Patching, Loring, Alaska.—White turnips (Early White Milan) were almost a failure. American Purple Top rutabagas did splendidly, some of them weighing a little over 13 pounds each, and I don't think there was one in the patch that weighed less than 2 pounds, and the quality could not be surpassed. About 3 tons was raised.

Carrots (Chantenay) did well and the quality could not be beaten. About 2 tons was raised. White Stock carrots did fairly well, but for some reason grew very high out of the ground and were very crooked.

Chives did well and were cut several times during the season. Rhubarb, as usual, did very well. Radishes were very fine, made a quick growth, and the quality was better than usual. Lettuce always does well and was no exception this season. May King made splendid heads and White Cos was crisp and of fine flavor. Cauliflower (Snowball) was the finest I have ever seen or tasted, with heads large, close, and very white. The cabbage varieties, Early Jersey Wakefield, Lilly's Glory, and All Seasons, all did fine, and the percentage of good heads was very large, some of them weighing almost 20 pounds. About 1,600 heads were raised.

Celery (White Plume) was raised for the first time and the heads were rather small, but the flavor was very fine.

String beans did fairly well and the quality was good. Peas (Gradus and Alaska) as usual did splendidly and yielded abundantly, and the quality was very fine.

Spinach did not do very well. Collards, as usual, did fine. The leaves are broken off, leaving the head, and as they grow very rapidly can be gathered about every 10 days, and so produce an enormous crop of greens during the summer.

Onions (White Queen) did well, were used green, and are very mild. Swiss chard was tried for the first time, and was very fine. It can be cut about every 10 days.

Hyacinths, tulips, and Tiger lilies all did splendidly. Poppies did well and were from volunteer seeds. California poppies did well and also volunteered. Flowering sage has lived out in the ground for several years, and always does well. Double daisies do so well as to be almost a nuisance. Mignonette was very fine. Nasturtiums did very well. Chinese pinks live out all winter and do very well. Pansies do fairly well in the summer, but they do not winter well.

Sweet peas seem to do a little better here every year; grow to a great height, sometimes 6 or 7 feet, produce an enormous lot of blossoms, and are extremely fragrant. Violets lived through the winter and produced lots of leaves, but very few flowers. Roses raised here were very fine. Some wintered over, but not very well, and some were set out in the spring and produced an enormous amount of blossoms. Sixty-nine blossoms were counted at one time on a Frau Karl Druschki, and the bush was not over 3 feet high at the time. Sweet Brier lived throughout the winter and made a growth of over 6 feet. Climbing roses did well and Crimson Rambler made a growth of 7 feet, and Dorothy Perkins of 7½ feet.

Two Himalaya Giant blackberries were set out and did fairly well; one of the canes grew 12½ feet long, and was trained on a fence. Red raspberries did very well, as usual.

Can you tell me a remedy for root maggots, which are very bad here and destroy a good many cabbage plants, and some seasons are very bad on radishes and turnips?

H. Papke, Commercial Club, Petersburg, Alaska.—The following reports my success during the past year with seeds and sets received from you and from seed houses.

Of nine apple trees sent me two years ago five are now alive. Some of them grew 2 feet high this year. Raspberry bushes all died on account of planting in sour ground. Of the gooseberry bushes one kept alive and bore small green fruit. Several raspberry bushes I received from Mrs. Campbell are doing well, bearing medium grayish-red berries. Five of the currants are alive. Two bore fruit, one white and one red, the fruit being very small, but making several layers. I have several kinds of strawberries in fruit which were raised from seeds and not classified. I will send sample if desired. The biggest berry weighed 11 pennyweight.

I managed to get a small quantity of rye, oats, wheat, and barley ripened. Millet did not do well. I only procured a few grains from 12 heads.

White Crease Back beans did fairly well. Pole Lima ripened. Long Telegraph, Improved Stratagem. Horsford Market, and Dwarf Gray Sugar peas all bore well. Horsford Market had a small pod, but the best flavor.

Russian Mammoth sunflower bloomed well. Some seed ripened, but the blue jays ate most of it before it was ripe. Flax bore well and ripened, but the fiber was inferior.

Several species each of rutabagas, parsnips, turnips, carrots, and radishes all did well. Beets did well, but the gopher mice ate them. Several varieties of lettuce did well, and I find that Big Boston and Black Seed Simpson do best. Several species of cabbage all did well. Flat Dutch and Drumhead did the best. Cauliflower and kale did well. Brussels sprouts grew well, but did not develop sprouts. Jerusalem artichokes grew 16 feet tall with roots the size of walnuts. Squash grew to the size of a man's fist, and the mice ate them. Rhubarb and horse-radish did well. Rhubarb was 18 to 24 inches tall and

three-fourths inch in diameter. Garden cress did well. Only one plant of water cress grew.

Several rows of potatoes were planted 3 feet apart. The weight of potatoes in one 45-fot row was 110 pounds. The crop was not as good as usual. I do not know the name of the potatoes, but they have a smooth, white skin. I have used my own seed since 1908.

Alfalfa grew 3 feet tall and bloomed, but formed no seeds. It will not grow in swamp. Red and Swedish clover do well in swamp, and some of it has stood four winters.

Meadow fescue, reed canary, and water meadow grass did not do well. All were tried in swamp. Millet will do well in swamp if manured. Poppies (mixed), calendula (mixed), mignonette, Chinese pink (mixed), coreopsis (mixed), dahlias, sweet alyssum, wild asters, tall and dwarf nasturtiums, petunias (mixed), pansies, columbine, Alaska blue iris, all did well. Aster seeds did not come up. Sweet peas and morning-glories bore very few flowers. Larkspur was inferior.

I tried to raise native lagoon berries, which bloomed, but bore no fruit, due, I think, to my lack of knowledge of cultivation.

James McGuire, Haines, Alaska.—I had a splendid crop last year. I had about 4 acres under cultivation, and I raised about 300 sacks of turnips, about 100 sacks of rutabagas, 150 sacks of potatoes, and about 100 pounds of cabbage. I also raised 8 Hubbard squash that weighed 20 pounds each, all ripe, and I had 10 pumpkins that weighed 16 pounds each, that were also ripe. In addition to the above I raised about 12 or 15 nice cucumbers. I think these squash and pumpkins were the first that were ever raised in this part of the country. The summer squash did fine.

Your flower seeds grew very well, but they did not mature.

I would like to have some of your currants, gooseberries, and some grapes to try next year, and if I am not asking too much I would also like to try some of your Red Swedish turnips.

My ranch is 2½ miles from Haines. I shall have about 7 acres under cultivation this year.

A. Hilvera, Anchorage, Alaska.—My gardening this year was a partial failure on account of rabbits being too thick around here. They seem to be a veritable curse to a community wherever they are getting too numerous. Hardly anything escapes them. Nearly everything I planted in the ground, from timothy seed to fence posts, they went at good and plenty. The only things they did not bother much were potato vines and strawberry plants, and consequently I raised a fair crop of good, marketable potatoes; that is, 2 tons from a quarter acre of land. Some of them weighed 1½ pounds. The strawberries were a success too, and I found a ready market for them in the town of Anchorage. Some of the lettuce, rutabagas, radishes, and a few turnips, which I saved from being destroyed by rabbits, did fairly well, as usual. Some of the turnips weighed 11¼ pounds each.

I have grown all the Petrowski turnip seed necessary for my own use ever since I received some from you for a starter four or five years ago, when the seed was imported from Finland. Last year (1914) I tried the turnip seed grown at Rampart which you sent me over a year ago. Some of the turnips were yellow and some white. The white ones were more pithy than the others. Neither of them grew very large. I shall give them another trial next year, for I have some of the seed saved for that purpose.

Geo. Roll, Hope, Cook Inlet, Alaska.—I herewith submit to you a report on our success in gardening for the season 1915. The spring of 1915 was very early and favorable for planting. It was one of the earliest since 1896. We com-

menced planting April 27, and we ended our planting May 20. The summer was very dry and warm, being the longest and warmest we have had since 1896, although we have had other summers which had been fairly dry in which we also had good crops. This past summer (1915) our crops were very good. Our potato crop excelled that of any previous year both in yield and quality. The yield was from 575 to 750 bushels to the acre. All other vegetables did exceedingly well, such as cabbage, beets, carrots, turnips, rutabagas, cauliflower, parsnips, peas, celery, radishes, and lettuce.

The root maggots troubled the cabbage, turnips, rutabagas, and radishes to such an extent that only a very few plants, if any, escaped damage, a good portion of them being killed altogether. About half or two-thirds grew. For this reason a great many people do not plant any of the above-mentioned vegetables.

The trees, such as apples and plums, which I received from the Sitka Experiment Station in 1913, made a large, strong growth during the season 1915. This winter (1916) being very cold continuously, it remains to be seen whether the trees will stand the severe winter or not. It will certainly be a good test if they escape without being winterkilled. Such a cold winter may not occur again for years. It is safe to say that this winter thus far has been as cold as any, if not the coldest, since 1897. The old pioneers say that they can only recollect one winter colder than the present, that being 1896. I have tried trees, such as apple, pear, and plum, two different times since 1899, and in the course of four or five years they all were winterkilled.

The strawberry plants you sent me in 1912 and 1914 produced a vigorous, heavy foliage, but very few berries, and, therefore, they may be considered a complete failure. The same is true of all others, including the Alaska strawberries. I believe the reason is that I have them planted in too heavy a black soil. Currants from the States, as well as the ones from the Sitka Station, do extra well every season, without a failure since 1902, always producing a large crop. The native currants do not seem to do as well. Many years the blossoms were killed by frost the latter part of May or beginning of June, while the first mentioned do not commence to bloom before June 10 or some such date. There being no market here for currants to amount to anything, I had to destroy two-thirds of the bushes, since one to two bushes will produce all the currants one family can use.

Gooseberries also do extra well. I planted five bushes in 1902. I had the first picking in 1906, and since that time have picked as high as 150 pounds in one season. I believe when the bushes get to the age of 13 years or over they are then too old and do not produce a normal crop. At least, that is my observation.

Raspberries have also produced good crops. I obtained the bushes from the Sitka Station some 10 years ago, and during this last season, which was from July 25 to September 20, approximately, we picked 270 pounds from a space 6 by 70 feet.

I would like to try some other gooseberries, possibly some of the red varieties you name in your report, also blueberries, loganberries, Wisconsin and Michigan cranberries, and rosebushes. I would like two of each kind if they are available. A few cherry trees would be a good thing to try, as would also salmonberries.

I would also like to have 2 or 3 pounds of your best quality potatoes. I have Gold Coin of your stock, and they have given good satisfaction, producing large, round tubers and heavy yields. The Irish Cobbler I do not consider very good.

F. F. Winchester, Matanuska, Alaska.—I raised about an acre of barley, one-third of which was bearded, and about one-third of an acre of oats from seed from Seattle. Both barley and oats had wild oats, mustard, and cockle mixed with them. They both made fine hay. I also raised 8 tons of marketable potatoes from three-quarters of an acre of ground. My best yield was 4,590 pounds of Gold Coin potatoes from 100 pounds of seed, or over 17 tons per acre.

I have on hand 125 pounds of Vermont Hull-less barley for seed in the spring. I sowed about three-quarters of an acre of timothy and alsike clover in my grain last spring. The clover grew rank around the edges of the patch, but did little in the grain. It may come out all right in the spring.

I have tried raising pigs this summer, feeding them turnips, rutabagas, mangels, sugar beets, cull potatoes, and a little corn meal, and I find that their growth and gain is not satisfactory without more grain than I can afford to feed them at present. I think goats or sheep would mature as quickly as hogs, and we would do much better with them than with hogs on the kind of feed we will have for them during the next few years. My chief objection to cattle is the length of time it would take to get them ready for market.

Our greatest handicap at present is a lack of work horses, and I presume we will either have to do without them for a while or go outside and buy them.

Ed. Mullen, Long Lake, Chitina, Alaska.—I wish to report the result of my trial of your seeds that I planted this year. The radish, lettuce, beets, turnips, and rutabagas grew very well, but the turnips, rutabagas, and radish were badly damaged by a worm that ate the top and a maggot in the vegetable itself. I understand that you have a species of turnip and rutabaga that these pests do not bother. If so, will you please let me know if I can buy some for my next year's crop. I will want enough for about 3 acres, possibly 4. If you have anything to put on the plants that will keep the worms off, let me know whether I can get it, how much it will take per acre, and how much it will cost.

John E. Barrett, McCarthy, Alaska.—I am giving you a few notes from my diary on the 1915 crop.

Earliest of All Alaska peas, planted April 20, had some blooms June 1, and by July 1 pods were filled and ready for eating (Pl. XV, fig. 1). Irish Cobbler and Early Rose potatoes, planted April 30, were large enough to eat July 1 (Pl. XV, fig. 2). Lettuce was large enough for use June 10. Hubbard squash were in bloom July 1 but produced no squash. Tomatoes, in bloom July 2, produced large green tomatoes, but they never ripened. Cucumbers, in bloom July 3, produced cucumbers 6½ inches long, which ripened in August. Onions from seed were large enough for use July 1. Sweet peas bloomed July 1. Nasturtiums were in bloom June 30 and morning glory June 27. Hull-less barley planted June 1 ripened and produced heavy grain, but did not grow over 20 inches high. This seed was from the Fairbanks Station. I tried Netted Gem Yakima potatoes here in 1915, and they attained a weight of 2 pounds and proved to be excellent.

Last year was a little too dry here, but would have turned out to be a banner season for extra heavy production under irrigation.

My peas produced two crops for the first time. I planted some of the first crop in July, which grew to a height of 18 inches before the season closed but did not bloom. The Petrowski turnip grew to a large size and proved to be excellent and not bothered by root maggots. I am wintering some to raise seed

from next year. I would be very glad to get some Petrowski turnip seed from you for the coming season.

Of the strawberries I got from you about 5 years ago, one lived but did not bloom until 1915. I planted some of those I got from you last year with it, and it produced large berries for the first time. The raspberries and currant bushes I got from you also about 5 years ago are producing fine. I now have raspberry bushes enough to plant an acre by splitting them up.

T. E. Phillips, Jack Wade, Alaska.—I have inquired of several parties relative to farm products, and the replies I have received are invariably favorable.

Potatoes grown here this year were more prolific than at any previous time, being large, well formed, thin-skinned, and mealy. They are now and have been since September 1, selling for 15 cents per pound, as against 25 cents 4 weeks earlier. Several parties sprouted the potatoes before planting. Three parties planted the sprouts only, and they have informed me that they simply broke off the sprouts haphazard from the overwintered potatoes and planted them, with results somewhat similar to those from seed potatoes. The yield was exceptionally good, and they were sorry they did not plant more of the sprouts. Possibly the favorable season had a great deal to do with such success, however, being warm and dry in June and a part of July, with enough of July rain for a good growth of crops. * * * The sprouts and seeds were from Eagle-grown potatoes, which were Early Ohio.

The vegetables also did well this year, some of the boys planting a small amount of each of all kinds of the Government seed received, not even omitting flowers. In sending the boys seed next year you would do them a great favor if you would send them yellow Rutabaga seed, which is hard to get hold of here. The other varieties of turnips are subject to worms, at first at the root, but which destroy the whole turnip later. The yellow rutabaga seems to be partly immune to such attack.

N. M. Patterson raised a pink-top white turnip successfully, getting some 100 pounds of roots weighing from 7 to 8½ pounds each. They were both large and solid. I saw them and asked if they were hollow, and he cut one, which was solid and not pithy; and he told me they were all alike. He also got several hundred pounds of smaller ones of the same kind. He says that he thinned them to 2 feet on some of the rows, and the 8-pounders were the result. Nils Akesson also got a good yield.

A. A. Burglin, Crooked, Kuskokwim, Alaska.—I wish to thank you for the seed you sent me last winter, especially of the Petrowski turnip. All other turnips were full of root maggots, but Petrowski had not one, nor even a blemish of any kind. Something ate or killed almost all of my turnips and rutabagas in the spring as soon as they came up. About 10 days after they were up I noticed they were drying up, and I examined the dead lots of them, but could not see or find anything on them. It is my opinion that some bug or insect must have been the cause of their decay. This is the first time I have noticed such a failure. I have been here and raising vegetables since 1911 (5 seasons), and have raised various kinds of vegetables, as turnips, cabbage, rutabagas, potatoes, carrots, onions, parsley, lettuce, radishes, parsnips, celery, and beets, but the latter were never a success. I have experimented with barley, oats, wheat, and timothy. The barley got ripe. The oats did not ripen fully but made fine hay, while the wheat was no good. I picked up a few heads of timothy out of the hay, some of which came up and grew about 4 feet high the first year. Barley, oats, and wheat were all common seed which I picked up. I would like to get some good northern seed. I would also like to experiment with fruit trees.

All kinds of berries are plentiful here. There is one berry here I have never seen before. It tastes like the best-flavored strawberry, and its leaves are somewhat similar, but it very much resembles the raspberry in general appearance.

I wish you would tell me what to do in case my turnips are attacked again as they were last year. I am a homesteader here and intend to make a trial of everything. Vegetables are doing fine, and I do not suppose they could be excelled anywhere. Turnips and rutabagas weigh as high as 12 and 14 pounds each. I simply planted the seed and did not do anything further to them until I took them up.

William Knox, Flat City, Alaska.—The potatoes you sent me were making a fine showing, but the frost of August 20 cut them down completely, and consequently the result will be a very light yield. As I am taking the next boat for the outside I will not be here to report the yield at time of digging.

I wish to have some Petrowski turnip seed, possibly a pound or two if such can be had, this fall or during the winter, in order to be in readiness for next season's planting. The root maggots were quite severe with us this year on turnips and cabbage.

Mrs. A. V. Thorns, Tacotna, Alaska.—I wish to let you know the results from planting the Petrowski turnip seed No. 22755, as you request. It is certainly a fine vegetable, and did surprisingly well, as our garden is at the head of the valley and the snow lies much later here than elsewhere on the creek.

I wish to thank you for the seeds and would like you to send me a few packages at your earliest convenience, so I can be in readiness for next spring, as the mails are very irregular and are more or less delayed here.

J. N. Bain, Hot Springs, Alaska.—I have been engaged in farming at the mouth of Baker Creek on the Tanana for 6 years, and have now 60 acres in cultivation, with an irrigation ditch to cover most of the ranch. I made a mistake in the first 3 years trying to raise oats for hay, but during that time I must say that I was experimenting in different grass seeds to find out which kind would be the best for this part of the country. I now seed 5 pounds *Bromus inermis*, 5 pounds Western rye grass, 3 pounds winter vetch, 2 pounds Montana alfalfa, and 3 pounds tall meadow oat grass to each acre. I plow my land in summer and disk it down a couple of times. Just before the freeze-up I seed and harrow in and roll. I have one plat which I put in this way 2 years ago, and which yielded 2½ tons of fine hay per acre, and it is my intention to seed all of my land in a similar manner. It certainly makes fine pasture in the fall. Every farmer should have a few goats or sheep to keep down the willows and make fertilizer for their gardens.

I sold to Kelly and Anderson on Sullivan Creek this season 136 rutabagas that weighed 1,150 pounds. I had several which weighed 17 and 18 pounds each.

I use tobacco dust and lime on the ground to keep the worms away and to draw the sourness out.

I must say the experiment stations are doing good work in improving the farming industry of Alaska.

John P. O'Callaghan, Fort Egbert, Eagle, Alaska.—This year we had what promised to be an exceptionally early season. I planted my garden between April 24 and 26. We had snow on April 27–28, and again on May 3 and 6, which put things back, and the weather remained cold for about 2 weeks and I thought everything would be killed off. However, toward the end of May we had fine, warm weather, which continued, with slight rains, until the beginning of September. The gardens turned out much better this year than usual, and consequently most people here had a fine crop of potatoes.

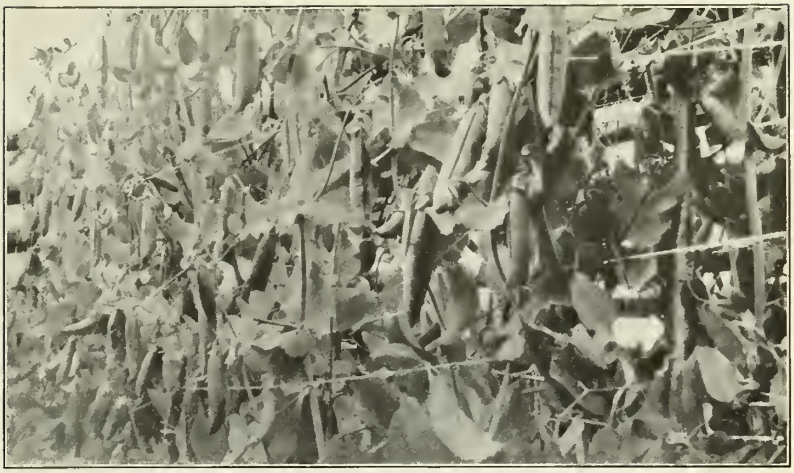

FIG. 1.—TELEPHONE PEAS, 8 FEET TALL, JOHN E. BARRETT'S HOMESTEAD, McCARTHY, ALASKA.

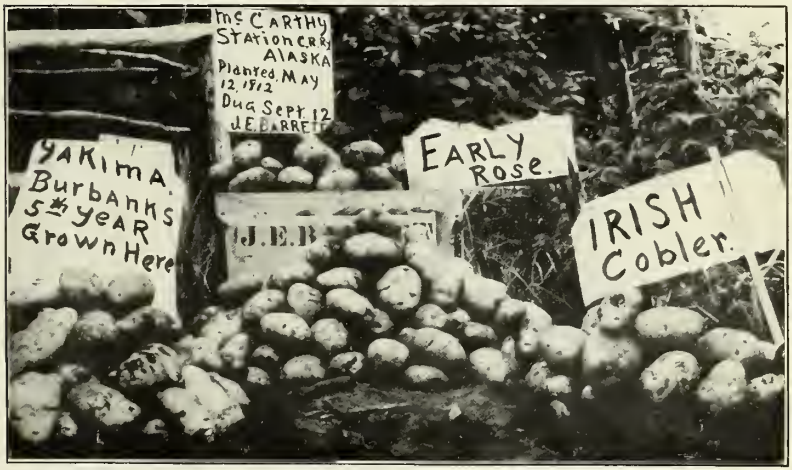

FIG. 2.—POTATOES GROWN BY JOHN E. BARRETT, McCARTHY, ALASKA.

FIG. 1.—SCHOOL GARDEN, SHUNGNAK.

FIG. 2.—NATIVE GARDEN, SHUNGNAK.

Of cabbage I planted about 50 or 60 plants of All Season and Early Jersey Wakefield, all of which headed well and were quite large and hard. The Early Jersey was the better of the two. Of peas I planted Improved Stratagem and Alaska. The former was far and away the better. I have never seen, in any country, peas of such large size and flavor and abundance of pods. Of carrots I planted James's Intermediate and Ox Heart. The former was much the better of the two, but both kinds did extremely well. Parsnips, Hollow Crown, were fine, and attained considerable size. I dug them and then left them exposed to the frost for three nights, and they became very sweet. Of beets we had Detroit Dark Red and Arlington Favorite. Quite a few of each sort went to seed before they attained any size. However, in general they were both good. Turnips did well, some of them reaching 10 inches in diameter, but worms or maggots ate some of them badly. Cauliflower did finely. It grew quickly, and the heads were large and of fine flavor.

Brussels sprouts were disappointing. They were planted May 20, and up to date have not yielded sprouts of any size although the plants were very large.

Worms [root maggots] attacked my young cabbage plants and I bought some very cheap tobacco (the kind called Siwash) and boiled about a pound in a 5-gallon oil can. I poured the liquid off and added another 5 gallons of water to it, and poured this solution around the roots of the plants. It did not hurt the cabbage plants, but it certainly fixed the worms for this year.

Will you please send me some seeds (vegetable and flower), and please include the Petrowski turnip? I would appreciate it if you would tell me how to pollinate tomatoes and cucumbers by hand.

Joseph Romaker, Sarah Chute, 25 miles below Circle, Alaska.—This is my report on seeds received from your station in 1914 and planted last spring. Everything did remarkably well except turnips, which will not do well here. They grow well but turn black inside, with the exception of the Petrowski, the seed of which you sent me in 1913 and which I planted as instructed on the package in 1914. I saved 4 good, large ones, and planted them last spring. Two of them did not grow, but I have nearly a teacupful of seed, the yield of the two that grew, for next year.

I have kept close account of some seed of Dwarf Blue Imperial Peas I have been saving for the past 7 years, which I planted 8 days later than other varieties, and I had peas 15 days earlier from the native seed. The seed you sent me did very well. I planted summer squash in hotbeds and grew them out in the open. Tomatoes and cucumbers do well here. In fact, everything does well with good care.

Last summer was a remarkably late season for frost. We had the first frost September 9. It is not unusual to have frost as early as August 15.

Thomas G. Power, Unalaklik, Alaska.—A few words relative to gardening and its possibilities here. Unalaklik is on a spit formed by a storm, and the soil is sand, with a thin stratum of surface soil formed by decomposed vegetable matter.' In a small parcel of ground around the house which I have manured potatoes, rutabagas, white turnips, and lettuce have been a success. Carrots, parsnips, and beets grow, but are small. Cabbage have been grown here and have formed small, soft heads. (I used indoors for a hothouse.) The potatoes were a little watery, but last year they were as good, but not nearly as large, as some outside potatoes. Owing to the necessity of my leaving here during the summer and not coming back until the fall I can pay but little attention to the garden, and that is the reason why my gardening is not a greater success.

Mr. Van Ness, the school-teacher, who has a good practical knowledge of gardening and also uses a hothouse, has been uniformly successful and has

matured cauliflower equal to any grown outside. The natives under his tutorship have started a cooperative garden this year, while individual natives have in the past made a success in a small way.

The mission has been in the gardening business for some time and has grown most of the potatoes and turnips used, together with radishes, lettuce, etc. So, to sum the matter up, gardening, if the proper attention is paid to it, can be made a success here, and every family can grow enough vegetables for home use, and if there were a market gardening could be made to pay.

J. L. Reed, Kotzebue, Alaska.—I have a family and have lived here since 1902 and will continue to make my home here. Should you favor me with such seeds and plants as you may deem suitable to this climate, I shall give them a thorough test. The department at Washington sent me timothy, redtop, and another grass seed to test this season, and it looks fine now. The weather has been very favorable for gardening this season. It has rained just enough to make conditions all that could be desired. I have lettuce here that can not be surpassed, in my opinion, in any part of the world. I am positive that it does a great deal better here than in Iowa. It is much more tender and crisp.

For several years I have been trying to get a start in rhubarb, but as yet I have not succeeded in getting the seed or roots. If you could send me some, and also some horse-radish roots or seed, I would greatly appreciate it. Fruit is high here and rhubarb makes good sauce and pies.

I have four gardens fenced with wire and all planted. My potatoes have already blossomed and are looking fine. One of my gardens is on an elevation, and therefore will not frost as early as on low ground. I have potatoes planted in all of the gardens so as to test the best place. I have nearly all kinds of vegetables growing this season. I have potatoes, squash, and cucumbers, and I know they will not be a success here, but I wanted to see how they would do. In addition to the above I have lettuce, radishes, peas, beans, carrots, parsnips, pepper grass, celery, turnips, cabbage, and other kinds of vegetables. My gardens have been fertilized by fish cleanings, and you can notice the growth daily at this time of the year. I will excavate for a hot bed this fall and put in a drain, and in the spring will put in horse manure and see if I can force many kinds of vegetables.

I find by sprouting potatoes that they are much advanced and do better. I would like to do my best on tomatoes in a hotbed with glass and with proper ventilation, since with the glass cover when nights are cold they may develop sufficiently to make nice pickles and even sauce.

Fred M. Sickler, Shungnak, Alaska.—I am sending you a report of the experimental gardening which I undertook in the summer of 1914, at Shungnak, Alaska, and of my supervision of native gardens at this point. (Pl. XVI, figs. 1 and 2.)

We had a very heavy late snow in the spring, so the only work that could be done before the break-up of the Kobuk River was to drain off the melted snow by means of ditches, and to hasten the melting of the snow by throwing on ashes and a thin layer of black earth.

I began the work of digging up the garden on May 21, but the soil was frozen in many places. I began planting seeds on May 23 and potatoes on May 30. Native-grown turnip seed was up on June 3, and was followed by other plants, so that by June 12 nearly all the seeds planted were up. The weather was cold and cloudy at the time. By June 18 turnips, radishes, and kale had second leaves, and Black Finnish oats were over 3 inches high. July 6 we were using all the lettuce, turnip greens, and radishes we wished, kohl-rabi was forming bulbs, and small potatoes were starting in the ground. July 14 Black Finnish oats were in bloom and about 20 inches high, and potatoes were

also in bloom. July 20 turnips were 2 inches in diameter, and kohl-rabi 1 inch in diameter. We began to use collards and kale on the latter date. July 24 a frost killed the potatoes at Dahl Creek at the foot of the mountains 4 miles distant and froze the tops of the plants on the Government reservation on the banks of the Kobuk River. The weather was entirely too dry for plants to grow well. During the middle of August there were several days of heavy frost, which killed the remainder of the potatoes.

On September 1 Black Finnish oats were 4½ feet high, a heavy and uniform stand, the seed seemed full and, I believe, was matured. I shall send you a sample as well as photographs.

Flat Dutch, Yellow Petrowski, Purple Top, White Globe, and some hybrid turnips were from 3 to 6 inches in diameter and weighed from 2 to 3 pounds each and were of the finest quality (Pl. XVII, fig. 1). The term "flat" does not apply to the white turnips we raised, as they were egg-shaped. The Purple Top Strap leaf turnip grew to a large size, but soon became pithy, seeming to be easily attacked by worms and maggots, which also destroyed most of our radishes, especially those of the long-rooted varieties. The Strap Leaf also split badly when the fall rains came. The Yellow Petrowski also had a number split by wet soil, but to a less extent than the Strap Leaf. The White Green Top was planted late and in a poor soil. The roots differed so in shape, size, and color as to indicate that the seed was not pure. I shall make another trial next year.

Kohl-rabi of both the White and Purple Vienna varieties were grown with perfect success (Pl. XVII, fig. 2). The purple variety was the larger, but in quality there seemed no difference, the bulbs weighing about 1½ pounds each and being 3 inches in diameter.

Lettuce, of which 12 varieties were furnished at various times by the Department of Agriculture, all did well, but not as well as some we raised several years ago. Endive did not produce very fine leaves, and the taste seemed rather bitter.

Rutabagas of the Purple Top Yellow and Purple Top White varieties produced very large leaves. The roots weighed from 2 to 3 pounds each, but were well flavored and suitable for table use.

Cabbages of several kinds were tried, but the Wakefield was by far the best, with the Winnigstadt as second best. The cabbage did not start to head until late, and the few that did make heads did not grow to a large size. Georgia collards and tall and short varieties of Scotch kale grew well and produced several crops of leaves from the same stalks.

Victoria rhubarb was planted, and 36 plants were obtained from one packet of your seed. These plants have been removed to the cellar, and I intend to replant them in the spring. I have some very fine rhubarb raised here from roots 2 years old.

Early Egyptian Turnip beets did well and produced roots about 3 inches in diameter. We pickled some for winter use and found them excellent. The long varieties were woody and small.

I planted 10 standard varieties of carrots, but the soil seemed too dry. When the fall rains came the plants made a rapid growth, but were soon checked by the frosts. The short-rooted varieties seemed to do the best. The largest roots were 1½ inches in diameter and from 4 to 6 inches long. However, they were excellent for table use.

Cauliflower gave only indifferent results. It is my intention to try next year with plants started inside the house.

I planted 12 turnip roots and obtained a pound of seed. I tried to raise parsley, but the seed in my garden failed to sprout and in other gardens failed to grow.

I have a cellar in the school building which is dug out of the gravel and lined with slabs and building paper. The ordinary fires in the building are usually sufficient to keep the cellar warm enough, but in the coldest weather we keep a lantern burning in the cellar. I have at present a half ton of turnips, rutabagas, kohl-rabi, carrots, and potatoes. They have been in the cellar nearly 3 months and are keeping in fine condition.

I wish to tell you about a potato which I introduced here 4 years ago. I purchased the seed in the open market in Seattle, and consequently do not know the name of the variety, which is locally known as the "Sickler-Shungnak Spud." This potato is of medium size, although some tubers grown in rich soil attain a very large size. In color it is white, and of a uniform, slightly flattened, oval shape. The eyes are shallow, and knobs are practically unknown. I am sending you some photographs of the same and wish you would tell me which variety it is. While other varieties of potatoes have been tried before mine and several have been tried since, at present my potato is the only one producing good results. Under favorable conditions this potato has produced 600 pounds of potatoes from 25 pounds of seed. Even in an unfavorable year like this, when the potatoes were harvested 75 days from the time of planting and had suffered from drought and frost, I was able to dig 150 pounds from 40 pounds of seed. From the few pounds of seed that I brought in enough potatoes have been raised to plant a number of gardens, and a couple of tons are now produced annually.

The soil at the Government reservation at Shungnak is a dark loam, the residue of decayed leaves mixed with silt. This layer is seldom more than a few inches deep, and below it is sand and gravel. At the time of planting there is an abundance of water from showers and from the melting snow. The level of the river is but a few feet below the surface of the gardens, so at the beginning of the season the soil is rather too wet and cold. Later in the season the water supply decreases and the level of the water falls over 12 feet, so the gardens are high and dry. During this time the plants are in much need of water and do not grow as they should, while the sun is warm and bright. If we had a pump we could easily double our production. We do not use any fertilizer, as the land is rich enough from the fish and other waste which accumulates about an Eskimo village.

As the new land about the village is rather hard to clear and to free from roots and stumps, and as all work must be done by hand, I have tried to find a place where there is good soil not covered with brush or trees. I found such a place about a mile from the school on a flat-topped hill covered with blueberries and moss. This ridge was surrounded by lakes and swamps, but was perfectly drained. The soil was a yellow silt or loam, about 2 feet in depth, while below it was sand and gravel. I cleared a large garden spot and planted it about the 1st of July. In order to determine whether the soil was of the right quality, I planted the garden in three sections, one of which was the soil with moss removed, the second the soil with moss burned on it, the third the soil with moss burned on it and fertilized with saltpeter. The results showed that the planting was in all cases too late in the season. The seed planted on the soil which had the surface removed was too poor to grow either turnips or potatoes, but the land that was burned produced small turnips and potatoes, and, I believe, will make a good garden. I am satisfied that no soil in this region can produce crops year after year without being fertilized, and that no soil in this region not covered with heavy vegetation can produce even light crops the first year, no matter how excellent the soil may appear to the eye.

FIG. 1.—TURNIPS GROWN AT SHUNGNAK.

FIG. 2.—KOHL-RABI GROWN AT SHUNGNAK.

FIG. 1.—NATIVE GARDEN, SHUNGNAK.

FIG. 2.—WILCOX'S POTATO PATCH, SHUNGNAK.

ALASKA

EXPLANATION

MAIN AGRICULTURAL REGIONS

AGRICULTURAL EXPERIMENT STATIONS

100 M. 100 M. SQUARES ARE EACH 100 MILES

SCALE OF MILES 0 100 200 300

SIBERIA

BERING STRAIT

BERING SEA

PT BARROW Utkiavie Barrow

Nigalik

PT HOPE

COLVILLE RIVER

NOATAK RIVER

KOTZEBUE SOUND

Kotzebue

Riley Camp

Shungnak

Bettles

Coldfoot

Wiseman

Caro

Chandalar

PORCUPINE RIV.

Ft Yukon

ARCTIC CIRCLE

KOYUKUK R.

Allakaket

YUKON RIVER

Beaver

Circle

C. PRINCE OF WALES

Deering

Candle

SEWARD PENINSULA

Teller

Nome

Council

Bluff

Solomon

ST. LAWRENCE I.

NORTON SOUND

A. EX. STA.

Rampart

Tanana

Chatanika Dome

Cleary

A. EX. STA.

Fairbanks

Ft Egbert

Eagle

Koyuk

Nulato

Ruby

Iditarod

Birches

Hot Springs

Holy

Cherio

Franklin

Chicken

Jack Wade

Dawson

YUKON DISTRICT

TANANA RIV.

Kaltag

Louden

Melozi

Nenana

ketchumstock

St Michael

YUKON RIVER

Innoko

Ophir

McGrath

Bonnifield

Donnelly

Paxson

Chisana

Anvik

Takotna

Andreafski

Holy Cross

Dikeman

Gulkana

Chistochina

VENTNA R.

Copper Center

Tonsina

Chitina

CHITINA R.

Kennecot

Nizina

ST MATTHEW I.

Bethel

KUSKOKWIM RIVER

NUNIVAK I.

Susitna

Beluga

Tyonek

Hope

Sunrise

Kenai

A. EX. STA.

Valdez

Fort Liscum

Wortmans

Landlock

Ellamar

COPPER R.

Orca

Katalla

KATALLA GLACIER

MALASPINA GLACIER

Seward

Resurrection

Latouche

PRINCE WILLIAM SOUND

MONTAGUE I.

Cordova

C. ST. ELIAS

C. YAKATAGA

YAKUTAT BAY

Yakutat

Skagway

Ft W. H. Seward

Porcupine

Kulkwan

Haines

Juneau

Treadwell

Douglas

Juneau

Auk

Shelter I.

Admiralty I.

Gastineau Channel

Auke Bay

Auke

Sumdum

Windham

Chichagof

Chatham

KRUZOF A. EX. STA.

Sitka

Kake

Petersburg

Wrangell

Tyee

Loring

Ketchikan

Metlakatla

Sulzer

Howkan

Craig

DIXON ENTRANCE

NEGATE STRAIT

QUEEN CHARLOTTE I.

Illiamna Lake

Iliamna

Homer

Seldovia

AUGUSTINE I.

Dillingham

Togiak

Mushagak

KVICHAK R.

Afognak

Kodiak

A. EX. STA.

AFOGNAK I.

SHELIKOF STRAIT

KODIAK I.

ALASKA PENINSULA

Chignik

Unga

UNIMAK I.

UNIMAK PASS

Unalaska

UNALASKA I.

DUTCH HARBOR

UMNAK I.

ISLANDS OF THE FOUR MOUNTAINS

PRIBILOF I.

BRISTOL BAY

THE HORRIS PETERS CO., WASHINGTON, D. C.

MAP SHOWING AGRICULTURAL REGIONS IN ALASKA.

I have received some ammonium sulphate and some potassium chlorid and intend to try these on the various soils about Shungnak next year.

When I first came to Shungnak, four years ago, I found the white miners at Dahl Creek raising small gardens, and it was generally supposed that vegetables could only be raised near the foot of the mountains. Several small spots had been tried in and about the village, but with poor success. I cleared some land the following spring, and the methods and results were so successful that nearly all of the natives began to raise gardens (Pl. XVIII, fig. 1), while the white miners have now made their most productive gardens close to mine. This year the gardens near the foothills were a complete failure, while those on the banks of the Kobuk were a success in spite of bad seasons.

There are upwards of 30 gardens in the village, and several families have nearly a quarter of an acre under cultivation (Pl. XVIII, fig. 2). These families depend as much on their turnips and potatoes for a winter supply of food as they do on fish.

CONDENSED METEOROLOGICAL REPORTS.

The weather conditions in many sections of Alaska are presented in the following pages in a much condensed form, but the facts are, nevertheless, given in such a manner that anybody who will take the trouble to study them may get a good idea of the climate as recorded at each of the stations named. The figures are based on one daily observation taken at the same hour every day; hence there are as many observations for each month as there are days in the month.

The columns headed "Temperature" contain, first, the maximum or highest temperature of the month; next, the minimum or lowest temperature which occurred during the month; the third column contains the mean maximum, that is to say, an average of all the maximum temperatures of the month; the fourth column gives the mean minimum or the average of all the low temperatures, and finally in the fifth column is given the daily mean temperature, which is an average of the mean maximum and mean minimum. The total precipitation includes not only the rainfall but also the snowfall, which has been melted and measured as water. The remaining four columns are self-explanatory and easily understood, in that they give for each month the number of days of clear weather, partly cloudy weather, and cloudy weather, and the days on which rain or snow fell. The latitude and the longitude of each station are given, so that the place may be easily located on the map.

Condensed meteorological reports.

ALLAKAKET. Latitude 66° 45′, longitude 151° 10′. Deaconess B. B. Mills, observer.

Month.	Temperature.					Total precipitation.	Number of days.			
	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1915.	°F.	°F.	°F.	°F.	°F.	*Inches.*				
January	21	−55	− 1.2	−22.4	−11.8	0.43	15	0	16	8
February	17	−58	− .7	−23.5	−12.1	.34	12	0	16	6
March	44	−46	22.3	− 7.4	7.5	.06	21	0	10	1
April	48	−21	38.9	17.2	28.0	.06	15	0	15	1
May	77	17	58.5	30.0	44.5	.46	26	0	5	1
June	86	29	72.0	44.0	58.0	1.04	19	0	11	9
July	85	34	74.7	47.3	61.0	1.14	16	0	15	8
August	75	33	64.5	43.2	53.9	16.19	10	0	21	10
September	63	18	49.3	31.0	40.2	3.38	9	4	17	10
October	43	−26	21.6	.0	10.8	.73	17	11	2	5
November [1]	18	−47	4.0	−16.2	− 6.1	.71	10	2	17	5
December [2]	32	−53	−11.8	−30.2	−21.0	.51	15	2	14	3

[1] For 30 days. [2] For 29 days only.

CALDER. Latitude 56° 8′, longitude 132° 27′. John McCallum, observer.

1915.										
January	44	21	38.2	30.3	34.2	12.90	3	5	23	23
February	47	23	36.0	28.1	32.0	6.70	4	15	9	19
March	62	26	48.7	33.3	41.0	14.10	7	12	12	21
April	55	25	48.7	35.5	42.1	14.70	2	13	15	23
May	75	33	61.2	39.9	50.5	2.75	11	13	7	11
June	73	33	60.2	43.0	51.6	5.00	8	12	10	16
July	73	44	62.7	50.6	56.6	2.70	11	13	7	9
August	75	41	63.7	50.3	57.0	12.51	5	14	12	18
September	69	37	57.6	46.6	52.1	10.17	7	11	12	21
October	55	31	47.8	37.0	42.4	19.21	1	12	18	28
November	45	24	40.1	33.8	36.9	15.76	4	15	11	27
December	47	20	38.5	28.2	33.3	17.10	5	8	18	23

CANDLE. Latitude 66°, longitude 161° 50′. R. S. Dimmick, observer.

1915.										
January [1]	38	−34	4.3	− 8.6	− 2.1	0	6	2	21	0
February	25	−44	−6.0	−18.8	−12.4	0	13	2	13	0
March [1]	25	−30	9.5	− 7.0	1.2	0	12	1	16	0
April [2]	55	0	45.0	26.5	35.7	0.10	8	10	10	1
May [3]										
June [4]	77	26	62.6	39.0	50.8	1.29	7	4	12	6
July [5]	77	34	67.5	46.6	57.0	1.59	1	7	18	8
August [6]	75	28	58.6	43.4	51.0	1.46	5	3	16	12
September [7]	60	24	48.9	35.6	42.3	2.12	3	2	20	12
October [1]	44	−22	24.3	7.1	15.7	.07	14	1	14	1
November	32	−40	11.7	− 5.4	3.2	0	7	1	20	0

[1] For 29 days. [2] For 28 days. [3] No record reported. [4] For 23 days. [5] For 26 days. [6] For 24 days. [7] For 25 days.

Condensed meteorological reports—Continued.

DUTCH HARBOR. Latitude 53° 54′, longitude 166° 33′. Emil Ittner, observer.

Month.	Temperature.					Total precipitation.	Number of days.			
	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1915.	°F.	°F.	°F.	°F.	°F.	*Inches.*				
January	40	10	34.1	25.2	29.6	5.04	3	6	22	18
February	44	10	35.3	25.6	30.5	2.36	4	4	20	9
March	44	18	38.4	29.6	34.0	8.66	4	1	26	19
April	48	22	40.7	30.7	35.7	4.18	2	3	25	11

EAGLE. Latitude 64° 40′, longitude 141° 5′. N. R. Meyers, observer.

1915.										
January	28	−30	11.4	− 5.5	3.0	0.47	9	1	21	10
February	30	−46	10.9	− 8.0	1.5	.09	19	3	6	2
March	52	−38	26.3	3.3	14.8	.61	13	2	16	7
April	60	1	51.2	23.1	37.1	.53	8	8	14	5
May	80	10	64.0	26.0	45.0	.34	14	9	8	5
June	92	29	72.6	40.6	56.6	3.30	9	7	14	15
July	89	32	77.1	44.1	60.6	1.55	7	10	14	16
August	78	28	68.2	38.5	53.3	2.30	7	8	16	15
September	64	17	54.8	31.9	43.3	1.35	3	6	21	12
October	46	−20	24.4	9.3	16.8	.47	5	6	20	7
November	33	−24	14.3	− 2.9	5.7	.33	5	5	20	6
December	22	−43	.5	−18.9	− 9.2	.70	14	1	16	9

AGRICULTURAL EXPERIMENT STATION, FAIRBANKS. Latitude 64° 50′, longitude 148° 9′. J. W. Neal, observer.

1915.										
January	21	−32	2.9	−12.9	− 5.0	0.12	4	7	20	2
February	36	−47	4.8	−19.7	− 7.5	1.6	18	3	7	7
March	56	−33	33.2	1.5	17.3	.16	13	6	12	3
April	61	3	49.7	24.7	37.2	.26	8	15	7	3
May	81	22	66.6	36.1	51.3	0	14	16	1	0
June	95	35	75.3	48.3	61.8	1.80	6	14	10	13
July	88	37	78.4	52.1	65.3	1.79	10	16	5	13
August	80	37	68.1	45.4	56.8	3.24	7	12	12	18
September	63	28	55.1	36.3	45.7	3.12	3	13	14	14
October	46	−15	27.7	9.9	18.8	.64	12	7	12	8
November	31	−36	10.7	− 4.7	3.0	.63	5	17	8	8
December	30	−34	− 3.1	−18.6	−10.9	.44	10	13	8	5

FORT LISCUM. Latitude 61°, longitude 146° 27′. Lieuts. Tenny, Meister, and Duckwall, observers.

1915.										
January[1]	42	10	34.9	23.5	29.2	8.5	10	5	16	12
February	40	8	33.3	17.2	25.3	3.75	9	3	16	9
March	54	13	43.0	29.0	36.0	3.33	9	7	15	9
April	48	22	43.7	31.0	37.3	12.17	4	3	23	20
May	65	27	59.8	38.0	48.9	1.02	13	8	10	3
June	75	27	63.7	42.6	53.2	1.52	12	4	14	6
July	83	42	71.2	49.5	60.4	1.19	21	4	6	4
August	70	39	62.0	44.3	53.1	7.4	5	2	24	16
September	71	34	55.7	40.4	48.0	8.65	7	4	19	23
October	60	15	39.4	25.9	32.7	3.54	9	10	12	12
November	42	5	33.6	17.5	25.6	9.53	4	6	20	13
December[2]	34	6	29.7	12.0	20.9	9.96	6	4	21	15

[1] 10 days only on maximum, 22d to 31st, inclusive.
[2] 14 days only on maximum, 1st to 14th, inclusive.

Condensed meteorological reports—Continued.

FORTMANN SALMON HATCHERY. Latitude 55° 20′, longitude 131° 40′. Fred Patching, observer.

Month.	Temperature.					Total precipitation.	Number of days.			
	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy	Rain or snow.
1915.	° F.	° F.	° F.	° F.	° F.	*Inches.*				
January	43	17	38.0	30.0	34.0	19.88	5	3	23	23
February	50	15	39.6	27.4	33.5	8.42	5	5	18	20
March	67	25	52.2	32.7	42.5	17.28	9	2	20	21
April	59	28	52.0	36.1	44.0	19.77	2	8	20	26
May	78	25	67.2	41.7	54.5	3.13	9	10	12	15
June	82	42	69.3	47.3	58.3	5.94	9	7	14	18
July	90	47	75.5	51.5	63.5	4.03	14	6	11	10
August	82	42	68.3	50.0	59.2	17.10	6	4	21	20
September	74	39	62.7	46.1	54.4	7.55	4	8	18	25
October	59	31	49.7	39.2	44.5	29.56	0	6	25	29
November	49	24	40.6	32.3	36.5	22.28	2	4	24	27
December	47	20	37.6	30.1	33.9	22.87	0	8	23	19

FORT YUKON. Latitude 66° 28′, longitude 145°. Dr. R. E. Murphy, observer.

1915.										
January	−15	−51	−10.3	−21.7	−16.0	0.45	15	6	10	3
February	11	−54	− 2.8	−21.0	−11.9	.15	13	2	13	2
March	47	−32	16.9	− 4.4	6.3	.08	14	1	16	2
April	57	− 6	42.4	17.2	29.8	0	13	7	10	0
May	78	17	63.0	31.4	47.2	0	17	6	8	0
June	100	35	76.2	45.0	60.6	0	6	7	17	0

GULKANA. Latitude 62°, longitude 144°. John Low, observer.

1915.										
January	31	−27	7.9	− 2.9	2.5	(1)	5	0	26	(1)
February	29	−35	9.4	−12.8	− 1.7	(1)	11	2	15	(1)
March	53	−10	34.3	11.7	23.0	(1)	13	8	10	(1)
April	54	10	44.2	24.3	34.2	(1)	5	15	10	(1)
May	74	18	65.7	30.3	48.0	(1)	21	2	8	(1)
June	82	34	69.2	44.4	56.8	(1)	13	5	12	(1)
July	98	32	79.6	43.5	61.5	(1)	2	28	1	(1)

[1] No rain gauge.

HAINES. Latitude 59° 14′, longitude 135° 26′. E. L. Winterberger, observer.

1915.										
January	42	15	35.3	25.3	30.3	5.48	7	4	20	15
February	42	7	34.0	19.4	26.7	1.85	8	3	17	6
March [1]	61	19	45.5	32.7	39.1	6.08	6	10	14	18
April [2]	57	35	49.0	35.2	42.1	6.15	5	11	9	14
May	84	29	67.9	41.	54.9	.35	24	5	2	2
June	90	41	70.2	48.2	59.2	1.45	16	11	3	6
July	90	47	77.5	52.1	64.8	.15	19	10	2	1
August [3]	74	39	64.9	47.8	56.4	7.73	10	3	13	14
September	75	31	60.6	44.5	52.6	6.85	9	14	7	8
October	59	27	45.0	34.0	39.5	8.40	4	5	22	15
November [2]	43	16	35.3	25.6	30.5	6.25	0	3	22	8

[1] 30 days. [2] 25 days. [3] 26 days.

HOLY CROSS. Latitude 62° 20′, longitude 159° 50′. J. A. Carrigan, observer.

1915.										
January	40	−15	10.6	4.4	7.5	1.05	10	2	19	8
February	31	−43	6.8	− 7.6	.4	.45	13	5	10	5
March	44	− 8	27.2	14.7	21.0	.82	13	6	12	9
April	48	21	36.7	22.0	29.4	4.62	5	10	15	18
May	74	25	58.9	38.1	48.5	(1)	14	11	6	.....
June	81	36	67.9	46.2	57.0	9.57	7	12	11	11
July	79	45	66.4	52.0	59.2	(2)	0	10	21	.....
August	70	36	62.0	46.9	54.4	1.45	5	12	14	8

[1] No gauge [2] Incomplete.

Condensed meteorological reports—Continued.

JUNEAU. Latitude 58° 18′, longitude 134° 24′. C. R. Reid and James Wyllie, observers.

Month.	Temperature.					Total precipitation.	Number of days.			
	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1915.	°F.	°F.	°F.	°F.	°F.	Inches.				
January	40	19	35.3	28.9	32.1	7.08	6	5	20	19
February	46	13	37.3	26.2	31.8	2.40	8	9	11	13
March	58	28	46.0	33.7	39.9	8.65	8	4	19	20
April	54	28	45.7	35.4	40.6	8.06	3	6	21	21
May	80	27	66.2	42.2	54.2	2.40	20	6	5	9
June	77	37	65.4	46.2	55.8	4.51	11	8	11	16
July	89	46	74.6	50.8	62.7	.25	25	4	2	4
August	74	30	64.9	36.5	50.7	6.83	12	4	15	14
September	73	24	58.2	34.0	46.1	10.34	7	3	20	23
October	57	27	47.7	34.9	41.3	9.12	5	10	16	23
November	45	25	39.5	30.6	35.0	8.61	4	8	18	24
December	43	16	35.7	28.7	32.2	8.92	6	5	19	21

KETCHIKAN. Latitude 55° 25′, longitude 131° 35′. A. P. Craig, observer.

1915.										
January	51	22	40.5	30.9	35.7	17.39	6	1	24	21
February	49	22	42.3	28.8	35.6	8.09	10	0	18	15
March	69	37	52.8	34.2	43.5	18.58	11	1	19	22
April	59	23	51.1	36.3	43.7	17.87	9	0	21	23
May [1]	81	27	65.0	38.7	51.9	4.31	17	1	13	12
June	82	43	64.6	47.8	56.2	8.17	15	1	14	15
July	82	47	71.4	53.0	62.2	5.12	20	0	11	11
August	82	44	66.7	51.2	59.0	19.42	9	4	18	20
September	74	41	62.5	48.0	55.3	7.63	12	3	15	19
October	60	30	51.7	40.0	45.9	26.62	3	1	27	29
November	49	24	42.1	32.7	37.4	26.58	3	1	26	28
December	48	23	40.6	32.0	36.3	20.57	3	0	28	23

[1] From May 13 to 28, thermometer out of commission.

KLUKWAN. Latitude 59° 25′, longitude 136°. Rev. F. R. Falconer, observer.

1915.										
January	39	0	29.6	17.5	23.5	1.82	9	1	21	14
February	42	− 6	29.5	8.7	19.1	.79	15	3	10	9
March	60	17	46.0	28.7	37.5	1.86	9	2	20	18
April	57	21	51.4	33.7	42.6	.78	10	2	18	10
May	84	21	70.4	35.8	53.1	0	19	5	7	0
June	91	38	69.6	44.4	57.0	.35	14	12	4	1
July	99	38	79.2	48.3	63.8	.85	19	6	6	3
August	77	41	66.6	46.5	56.6	3.76	10	4	17	16
September	74	31	60.0	43.3	51.7	2.64	11	5	14	10
October	57	21	43.9	30.2	37.1	2.63	5	7	19	14
November	42	2	32.4	19.9	26.2	2.40	3	7	20	18
December	36	− 6	26.0	13.3	19.6	3.51	11	3	17	21

KODIAK. Latitude 57° 45′, longitude 152° 30′. C. W. Heideman and Hiram E. Pratt, observers.

1915.										
January	42	10	37.3	28.7	33.0	7.98	1	12	18	25
February	45	8	36.8	25.2	31.0	5.37	6	9	13	20
March	54	21	42.5	33.6	38.1	9.54	5	10	16	24
April	51	15	43.8	33.6	38.7	6.71	1	15	14	18
May	62	34	54.6	38.7	46.7	1.91	13	6	12	6
June	69	41	59.5	48.0	53.8	3.66	8	8	14	12
July	76	44	68.5	50.3	59.4	.58	17	10	4	5
August	72	43	59.7	51.1	55.4	10.3	0	4	27	26
September	72	34	61.1	45.1	53.1	8.59	1	23	6	13
October	61	20	47.4	32.6	40.0	4.70	0	10	21	15
November	51	19	39.8	29.1	34.5	4.70	6	15	9	11
December	44	13	37.0	24.2	30.6	.99	11	5	15	12

Condensed meteorological reports—Continued.

NOME. Latitude 64° 30′, longitude 165° 24′. Mrs. N. S. Jolls, observer.

Month.	Temperature.					Total precipitation.	Number of days.			
	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1915.	°F.	°F.	°F.	°F.	°F.	*Inches.*				
January	36	−23	11.4	0.8	6.1	0.48	11	3	17	6
February	37	−36	3.4	−11.9	− 4.3	.70	17	2	9	4
March	36	− 9	22.5	10.7	16.6	.12	16	1	14	2
April	37	− 9	27.0	14.0	20.5	.87	4	3	23	9
May	56	15	42.7	30.2	36.4	.84	13	4	14	4
June	72	29	53.9	38.8	46.4	1.53	12	2	16	12
July	67	38	53.8	45.3	49.6	3.82	4	0	27	18
August	65	28	54.9	40.9	47.9	1.07	10	5	16	12
September	57	22	48.9	37.5	43.2	3.72	7	4	19	14
October	42	4	36.6	19.6	28.1	.99	12	5	14	7
November [1]	.....	−14	.....	8.1	.....	3.92	8	5	17	10

[1] Minimum only.

RAMPART. Latitude 65° 50′, longitude 150° 15′. Theo. D. Crippen, observer.

1915.										
January	11	−32	− 1.7	−10.7	− 6.2	0	8	12	11	0
February	21	−33	2.0	−12.4	5.2	0.21	14	7	7	4
March	52	−25	16.5	− .9	7.8	.07	17	8	6	2
April	66	−10	41.4	16.6	29.0	.08	3	20	7	1
May	76	14	59.0	28.6	43.8	.45	16	10	5	2
June	93	29	73.7	46.5	60.1	2.67	9	6	15	7
July	97	37	82.5	51.8	67.2	1.02	7	12	12	11
August	85	34	67.5	45.2	56.4	1.65	4	4	23	14
September	72	24	52.9	32.8	42.8	2.99	4	5	21	12
October	53	−20	24.5	7.4	16.0	1.38	10	7	14	7
November	15	−38	5.6	− 6.5	− .4	.42	3	10	19	5
December	19	−43	− 2.3	−16.4	− 9.4	.62	4	14	13	8

SEWARD. Latitude 60° 6′, longitude 149° 26′. W. A. McNeiley, observer.

1915.	°F.	°F.	°F.	°F.	°F.	*Inches.*				
January	48	8	40.4	24.1	32.3	7.09	4	7	20	14
February	55	10	36.7	21.6	29.2	3.73	14	1	13	12
March	67	11	49.3	31.8	40.6	9.67	9	15	7	17
April	55	26	46.6	32.3	39.5	11.96	9	9	12	17
May	77	34	61.2	42.0	51.6	.10	23	8	0	1
June	74	41	62.4	48.0	55.2	1.71	17	6	7	10
July	88	41	73.3	53.8	63.6	.94	23	5	3	4
August	68	42	60.4	48.6	54.5	12.71	4	12	15	20
September	74	39	58.0	45.3	51.7	9.46	10	8	12	18
October	58	17	45.5	31.3	38.4	2.82	17	7	7	10
November	47	12	34.3	22.6	28.5	6.24	19	2	9	8
December	40	9	29.8	17.5	23.7	4.99	15	1	15	9

SHRIMP BAY. Latitude 55° 51′, longitude 131° 30′. John Orchard, observer.

1915.										
January	41	21	35.8	30.7	33.3	14.9	7	0	24	19
February	42	21	36.4	29.4	32.9	3.72	8	7	13	12
March	58	28	47.4	34.5	41.0	9.73	12	3	16	9
April	56	30	51.2	38.0	44.6	9.70	8	8	14	23
May	71	39	61.7	47.1	54.4	2.73	21	10	0	10
June	78	44	67.5	50 3	58.5	3.48	14	9	7	12
July	90	47	75.2	55.2	65.2	3.28	19	8	4	8
August	80	45	67.9	52.8	60.4	10.26	13	3	15	16
September	71	32	61.7	46.8	54.3	6.75	8	6	16	18
October	56	29	48.4	35.4	41.9	4.57	1	5	25	29
November	45	24	39.6	31.8	35.7	14.87	5	3	22	27

Condensed meteorological reports—Continued.

SHUNGNAK. Latitude 67° 2′, longitude 155° 5′. Fred M. Sickler, observer.

Month.	Temperature.					Total precipitation.	Number of days.			
	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1914.	° F.	° F.	° F.	° F.	° F.	Inches.				
September[1]	50	11	41.8	17.7	29.8	0.08	13	0	8	1
October	44	− 3	34.9	18.4	26.7	1.21	6	15	10	6
November	30	−44	6.2	−12.9	− 3.4	1.10	14	1	15	5
December	35	−19	26.2	14.1	20.1	3.25	0	0	31	9
1915.										
January	28	−54	6.4	−18.3	− 6.0	2.11	7	14	10	6
February	22	−55	− 3.7	−20.9	−12.3	3.47	6	9	13	10
March	38	−40	18.5	− 7.8	5.4	1.60	10	10	11	1
April	45	−27	31.9	12.1	22.0	1.25	3	7	20	7
May	76	12	54.4	29.2	41.8	.87	14	12	5	2
June	85	32	66.1	43.3	54.7	4.36	9	12	10	14
July	82	42	70.6	49.4	60.0	4.33	0	12	19	17
August	75	25	62.0	43.4	52.7	4.06	1	9	21	19
September	56	20	47.6	30.8	39.2	2.95	4	14	12	12
October	40	−23	21.4	2.0	11.7	.36	13	8	10	7

[1] 21 days only, from 11th to 31st inclusive.

SITKA. Latitude 57° 3′, longitude 135° 20′. C. C. Georgeson, observer.

1915.										
January	55	25	43.7	33.2	38.5	8.22	5	7	19	21
February	53	20	43.6	31.2	37.4	4.56	5	8	15	15
March	66	32	52.1	37.4	44.8	4.98	8	5	18	21
April	55	32	49.9	38.3	44.1	9.76	3	5	22	25
May	75	28	62.6	43.6	51.3	.81	15	2	14	8
June	68	44	60.7	47.8	54.3	3.55	9	3	18	13
July	79	44	66.8	52.7	59.8	1.27	9	6	16	11
August	78	43	65.5	50.6	58.0	9.16	7	1	23	10
September	73	38	59.9	47.0	53.5	11.93	5	3	23	21
October	62	30	51.5	39.4	45.5	13.71	4	6	21	26
November	50	28	44.0	33.9	39.0	15.48	3	3	25	28
December	50	24	43.0	33.0	38.0	10.04	7	6	18	21

TANANA. Latitude 65° 13′, longitude 152° 2′. Violette J. Page, observer.

1915.										
January	17	−45	2.6	−11.6	− 4.5	0.37	21	1	9	9
February	17	−48	3.9	−13.6	− 4.9	.65	15	4	9	9
March	44	−30	21.3	5.4	13.4	.07	19	1	11	2
April	53	− 6	42.4	24.3	33.4	.27	10	6	14	8
May	81	23	64.5	35.0	49.8	.73	17	6	8	4
June	89	31	72.6	45.4	59.0	1.62	11	4	15	11
July[1]										
August	74	33	63.5	45.5	54.5	2.94	8	4	19	16
September	60	23	50.0	34.5	43.3	2.23	7	2	21	12
October	41	−15	20.9	8.2	14.6	.70	19	0	12	8
November	16	−39	3.9	− 7.5	− 1.8	.50	12	1	17	9
December	32	−44	− 4.6	−19.6	−12.1	.42	17	1	13	8

[1] No observations taken.

TONSINA. Latitude 61° 50′, longitude 145°. Ike A. Beal, observer.

1915.										
January	35	−28	6.0	− 9.7	− 1.8	(1)	6	0	25	.....
February	12	−37	−7.0	−15.1	−11.0	(1)	11	2	15	.....
March	38	− 8	13.5	7.9	10.7	(1)	23	0	8	.....

[1] No rain gauge.

Condensed meteorological reports—Continued.

VALDEZ. Latitude 61° 7′, longitude 146° 20′. Mrs. Laura Jones, observer.

Month.	Temperature.					Total precipitation.	Number of days.			
	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Daily mean.		Clear.	Partly cloudy.	Cloudy.	Rain or snow.
1915.	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*	*Inches.*				
January	38	− 3	30.1	14.7	22.4	4.29	3	11	17	15
February	37	− 9	29.2	11.1	20.2	2.48	7	12	9	8
March	49	11	39.6	23.7	31.7	3.16	6	6	19	16
April	47	16	41.0	28.0	34.5	9.55	2	6	22	24
May	69	24	58.8	34.7	46.8	.62	13	11	7	5
June	69	37	63.2	44.8	54.0	1.85	7	9	14	14
July	77	40	69.6	46.5	58.0	1.16	16	6	9	4
August	68	37	59.8	44.2	52.0	4.44	0	7	24	22
September	66	31	54.1	39.9	47.0	5.22	3	4	23	23
October	55	11	41.5	26.3	33.9	3.62	11	12	8	12
November	39	− 4	28.7	12.7	20.7	4.08	8	8	14	14
December	33	− 1	24.5	9.2	16.9	4.82	11	10	9	15